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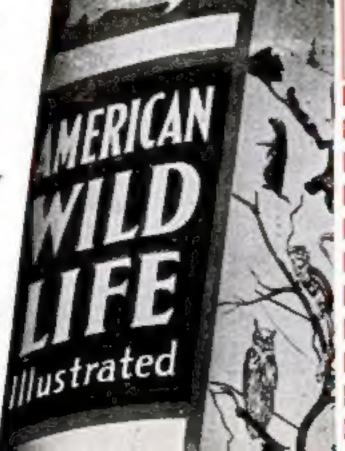
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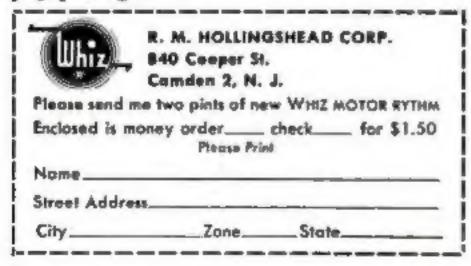


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Portable Rack for Home Tools

GOVERNMENT experts have listed the tools most often needed to maintain an American home. You'll find them all pictured in POPULAR SCIENCE next month, along with tips on taking care of them, and directions for making an inexpensive, portable rack.

Whether you are a beginner or an old hand at taking care of a house, you'll find this article helpful. Watch for it next month.

Testing for sound lost between telephone receiver and ear. Many subjects were used in these tests.

How to compensate for a curl... and add to your telephone value

The tube extended through the receiver cap into the ear canal. As sounds of many frequencies were sent through the receiver, the tube picked up a portion, and sent it through a condenser microphone to an amplifier. That sampling showed what the ear received.

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It's another example of the way Bell Telephone Laboratories work to keep your telephone service one of today's biggest bargains.

Bell scientists know that the telephone is not used under ideal laboratory conditions. There is never a perfect seal between receiver and user's ear. A curl may get in the way, or the hand relax a trifle. And ears come in many shapes and sizes. So some sound escapes.

Now, sound costs money. To deliver more of it to your ear means bigger wires, more amplifiers. So Bell Laboratories engineers, intent on a thrifty telephone plant, must know how much sound reaches the ear, how much leaks away. They mounted a narrow "sampling tube" on an ordinary handset.



Automatic recorder plots sound pressures developed in the car canal at different frequencies.

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You Can Influence Others With Your Thinking!

TRY IT SOME TIME. Concentrate intently upon another person seated in a room with you, without his noticing it. Observe him gradually become restless and finally turn and look in your direction. Simple—yet it is a positive demonstration that thought generates a mental energy which can be projected from your mind to the consciousness of another. Do you realize how much of your success and happiness to life depend upon your influencing others? Is it not important to you to have others understand your point of view—to be receptive to your proposals?

Demonstrable Facts

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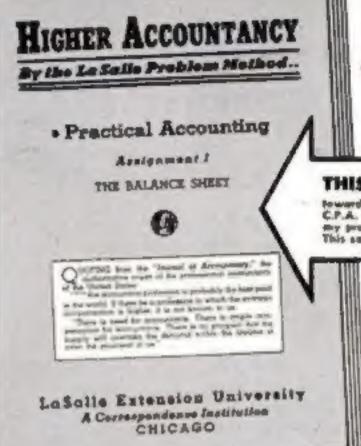
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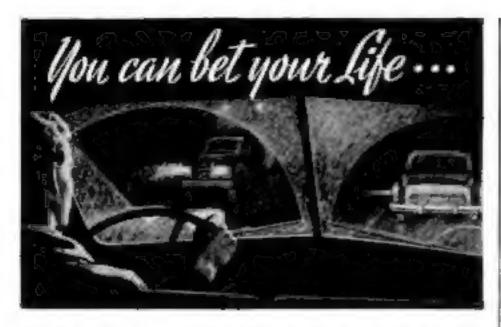
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Letters



Too Good to Lose

Sir:

I followed all the instructions in your September article [p. 207] on upping my car's value to get a better price. But—when



I finished, the car looked so good I decided to keep it.

AL AARON

Washington, D.C.

Lineup Unchanged

Sir:

One of the TV snapshots in your October issue, page 128, is a baseball action picture that—you say—shows the Brooklyn Dodgers playing the Cleveland Indians. Since those two teams are in different leagues, how could they meet—except in a World Series? You must have meant the Dodgers against the Boston Braves.

ALVIN MILLER

Boston, Mass.

Nope, Indians is right. The picture was taken during the telecast of a night exhibition game at Ebbets Field on July 24. The Brooklyns won, 6-4.

Speed vs. Space

Sir:

I can't agree with B. J. Stephenson's suggestion in your Letters column for October [p. 14] for reducing highway accidents by requiring that all cars have engine governors set at the legal speed limit. Granted that excessive speed causes most accidents, still a little extra power for sudden acceleration is handy for getting out of someone's way in an emergency.

A better idea might be to require all persons getting driver's licenses to go out on a highway or special track and see for

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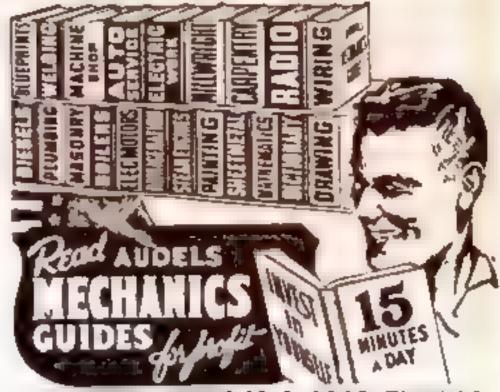
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ROBERT L. WEBBER

Berkeley, Calif.

Scoreless Wrenches

Sir:

Here's a stunt I pulled that might be

helpful to other P\$ readers:

To keep wrenches from scoring tubing and pipe, especially the chrome-plated parts of brass plumbing fixtures, I wrap the jaws with three or four thicknesses of friction tape. This gives a fine grip and leaves no scars.

A. C. WRITE

Savannah, Ga.

Shocking Situation

Sir:

Especially in winter, I suffer many shocking experiences from static electricity in my car. It was bad before I put on plastic seat covers, and worse afterward. After sliding into the car, I get a shock from the ignition key. Then I drive a while, slide out, and get another from the door. The shocks aren't dangerous, but they do sting.

What can I do to stop them?

CONBAD BALLIFT

Drums, Pa.

Dangling chains or special conductive tires are common ways to drain static charges off



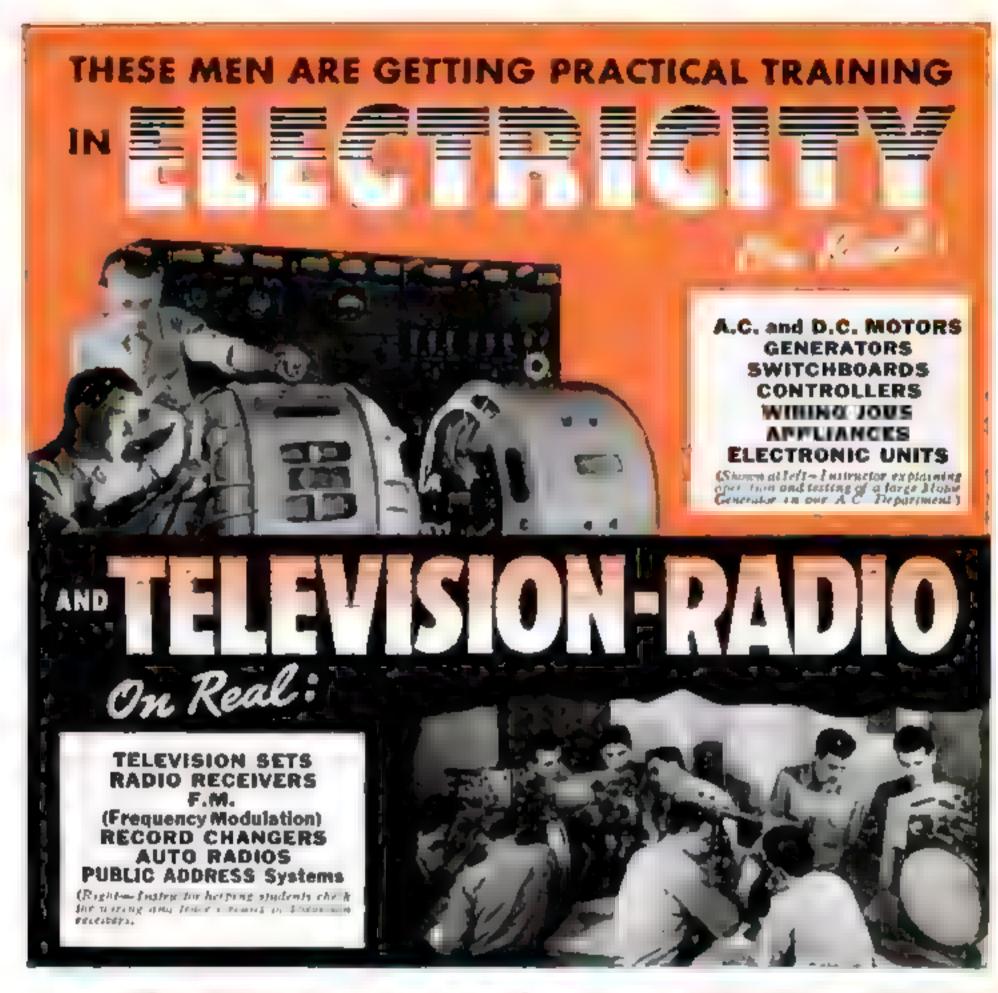
vehicles. These probably wouldn't help you, since your trouble seems to be a potential between you and the car. Try holding on a door handle while you slide in or out, to keep the potential from building up.

Early Super-Movie

Sir:

You featured in your August issue [p. 74] an article about Super-Movies. This projection system is more than 22 years old and has been shown in Europe. . .

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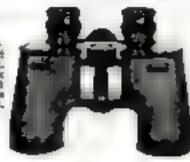
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projectors for the showing of a French film. "Napoleon," in 1928 at the Ufa Palace in Berlin, Germany. This film had a tremendous success, but the extremely high cost of this system prevented further application. . . .

ALFRED R. STAHL

Garnet Lake, N.Y.

Laurels to pioneer Stahl for his early work in super-moviemaking. Rarely does any important invention resemble nothing that has gone before. Unique features claimed for the current Cinerama process: "a continuous picture on a hemicylindrical screen"; the methods of photographing and assembling it; and the extremely large 55.5° by 146.2° angle that it covers. According to inventor Fred Waller, a complete search of patents and records going back to the earliest days of movie-making has been made, and patents have been granted on the Cinerama process and its parts in many countries throughout the world.

Off His Rocker

Sir:

Wilbur Shaw, reporting on the new Nashes in your October issue [p. 105], says that one reason the '51 Statesman's engine is so quiet is that clearances of the rocker arms on their shafts has been decreased, reducing valve noise. Apparently Mr. Shaw forgot that the Statesman, formerly the "600," has an L-head motor-which does not have rocker arms and shafts.

FAY O. WOOD

Elkhart, Ind.

Right-nice catch.

Safety Tip

Sir:

Your June issue showed, on page 221, a setup to do dovetailing, with the bit mounted in a Jacobs chuck. Is it not taboo to mount this or any router bit in such a chuck?

ALGEO H. BRILL

Marysville, Calif.

It is, if the chuck is mounted by the taper alone, since side thrust may pull the chuck off with disastrous results. But there's a sound way to make the chuck safe for such work. Drill and tap a hole in the end of the spindle, run a clearance hole up

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

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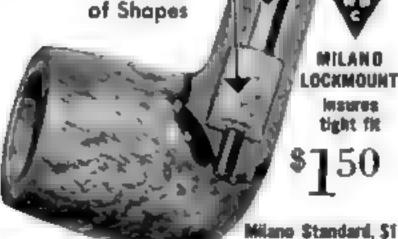


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through the chuck body, and secure the chuck with a screw. For full details, see PS, Sept. '46, p. 173.

Black or Blue?

Sir:

Your article on the President's new Lincoln convertible [Sept., p. 158] says the body is "coal black." The Ford company's Lincoln-Mercury Times printed a color photo showing it as bright blue. Who's right?

WILLIAM B. MADDOCK

Bloomfield, Ind.

The car was, and is, coal black.

Animal Business

Sir:

An article you published back in June 1949 [p. 200] on how to make circus animals from plastic got me started in a moneymaking business. I first made some of the animals as a hobby, and my friends liked them so much that I began turning them out in quantity to sell through local stores. Now they're selling out as fast as I can produce them.

RENE E. PITTET

Roswell, N.M.

Fancy Pants

Sir:

The photograph with the article "Car Bouncer Spots Squeaks" in your August issue, page 115, shows a car that seems to have Cadillac fenders but an Oldsmobile trunk lid. Which is it?

DANIEL DUET

Westwego, Ia.

The car was an Olds fancied up with special fenders to pass, at quick glance, for its more aristocratic cousin.

Now They Make It . . .

In "I'd like to see them make . . . " for October, K. M. Isbell, of Los Angeles, asked for "an automobile born that would sound only a low-volume toot . . . but would increase in volume the harder you pressed down on the horn button."

Buell, makers of truck and bus horns, is bringing out a horn for passenger cars with variable volume control.

CITY.

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

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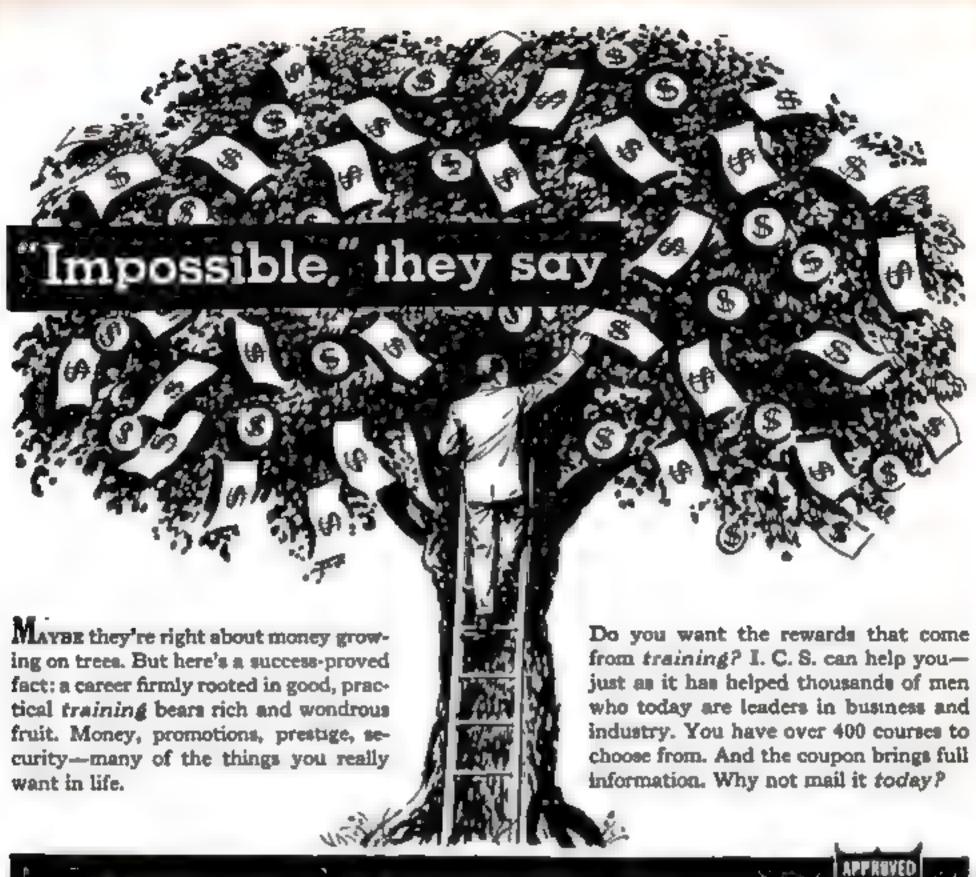
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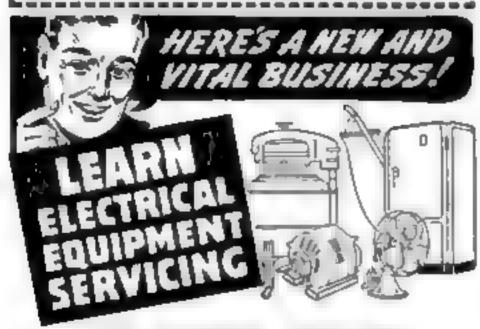
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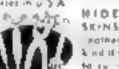
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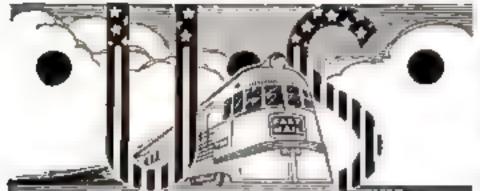
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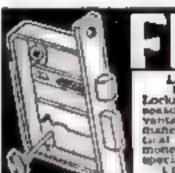


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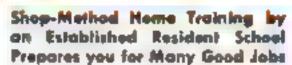
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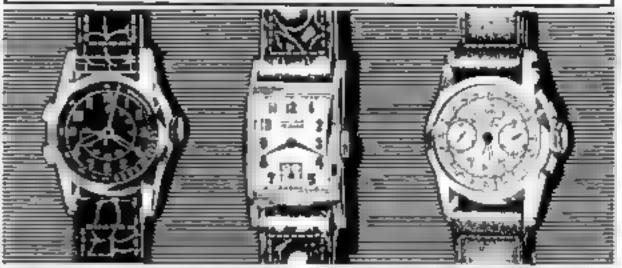
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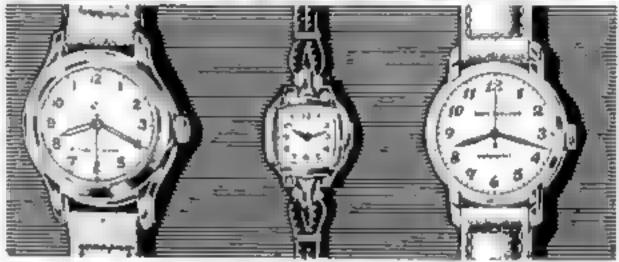
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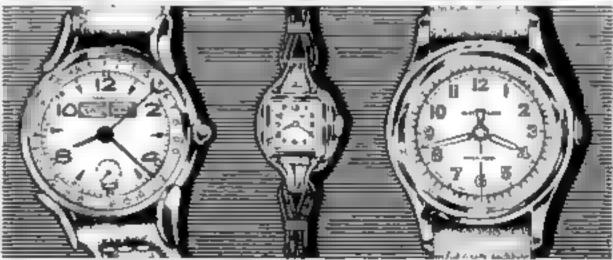
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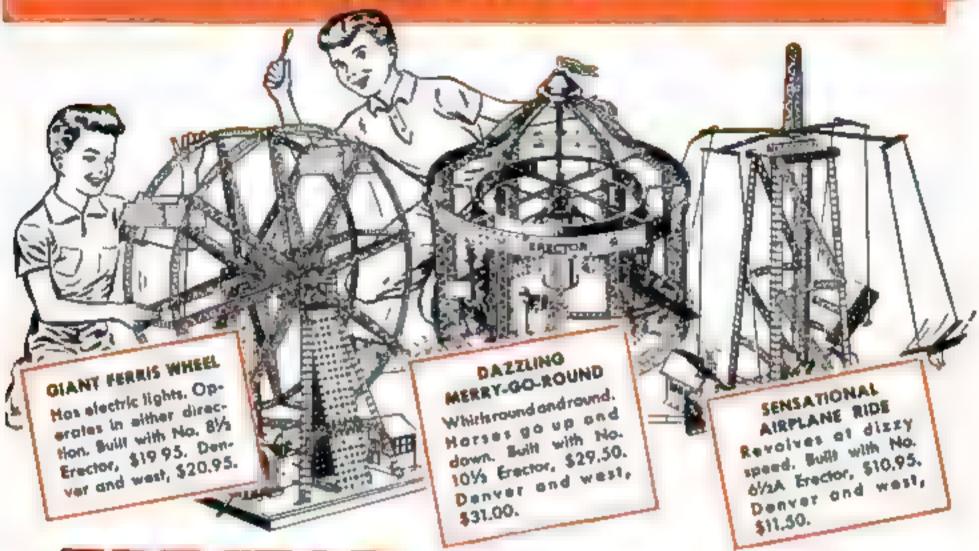


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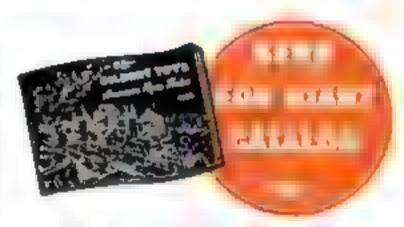
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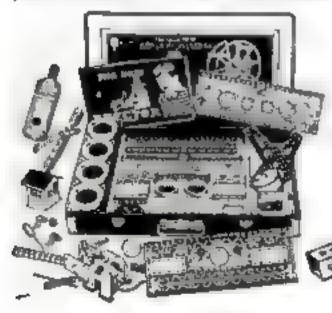
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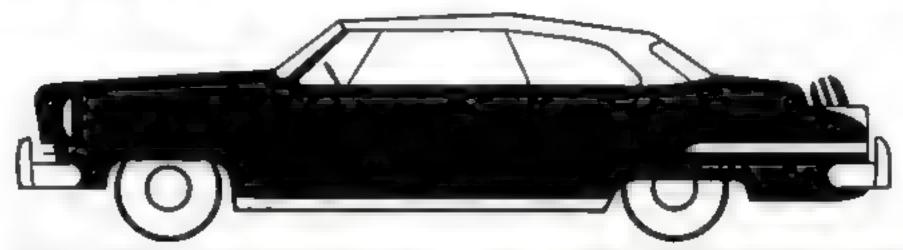
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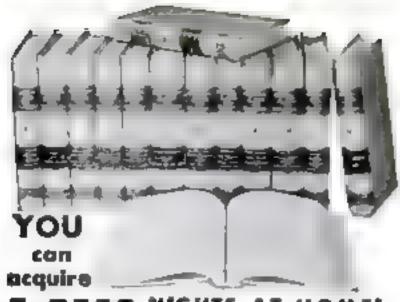
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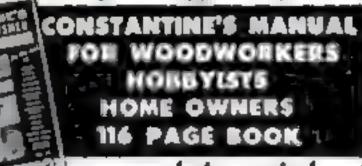
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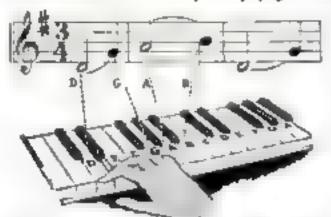
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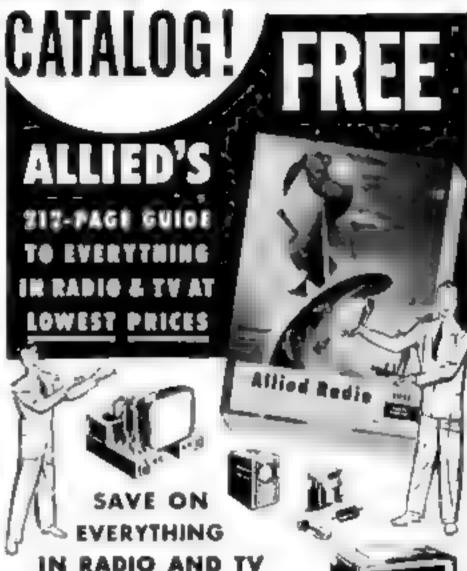


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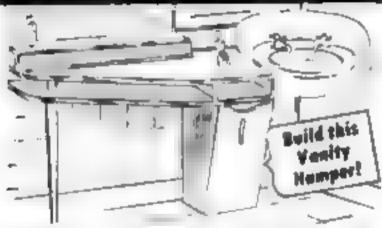
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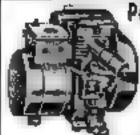


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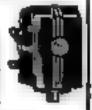


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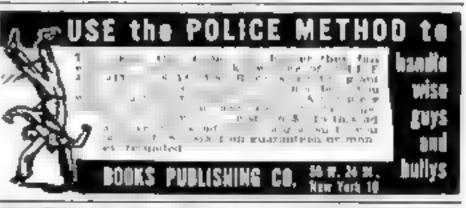
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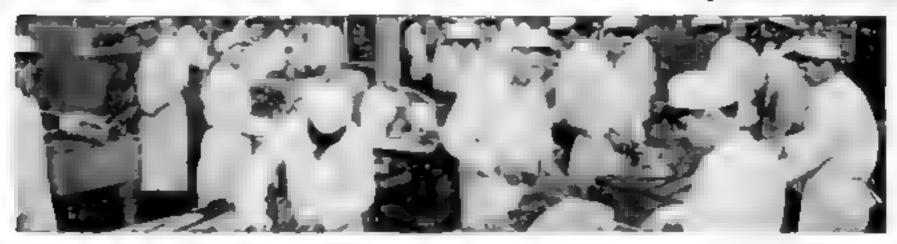
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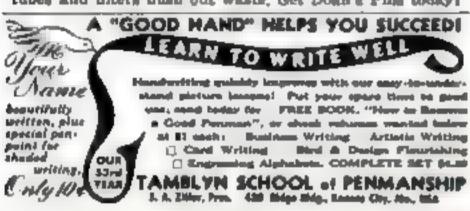


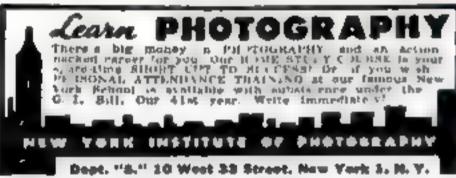
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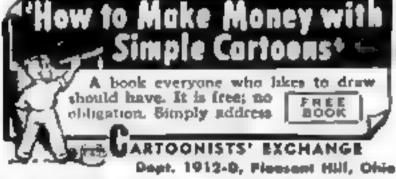
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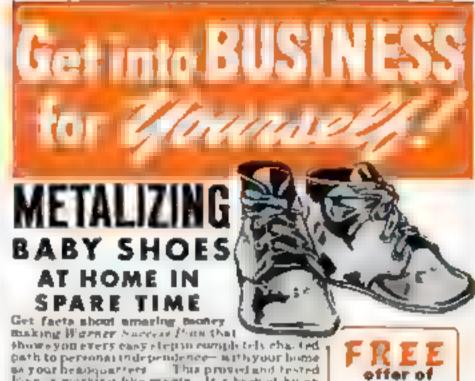












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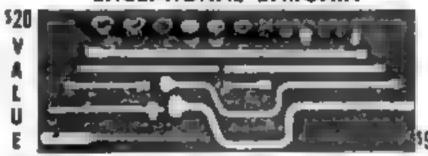
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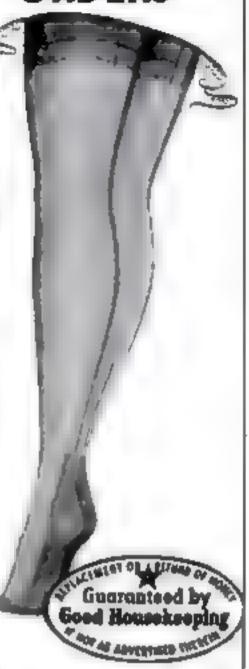


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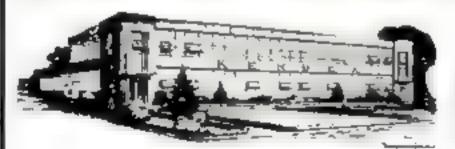


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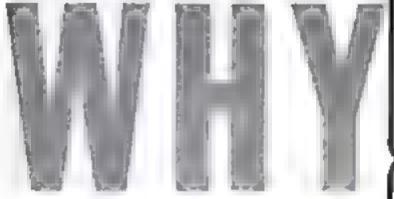
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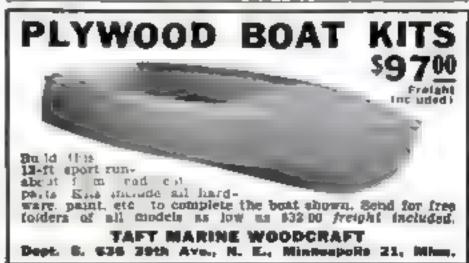
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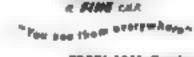
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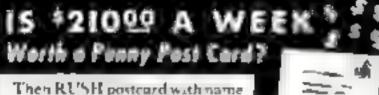
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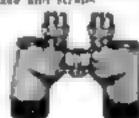
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DOM A INTURE COPE Actually runs of 75-HI III'M pro-duces 1 7 HP PED-SIP Height a full 314 inches weight b dunces.

Comes to you sembled ready for operation

marke We'ng CRAST, giving away

precis on deservery giving away a precis on deservery register complete with extended and piston, carburetor erank thousands of DEERLS all over he world and that been our production costs down, DEERLS is stream ined compact regist Starts quickly, each to install, runs for years! Fast delivery if you ORDER INSERT THEORY?

Sand \$2.96 plus 25c postage

GUTHAM BORRY CORF., Bupt. S. 107 E. 128th St., New York 35, N. Y. **************



KEEP FORDS ALL FORD with GENUINE FORD PARTS

Made Right to Fit Right to Last Longer

Each Christmes mere thousands give HULL AUTOMOBILE COMPASSES

EVERY CAR OWNER in your list will approclate to bundsomely designed, occupate, ecleration instrument that always shows the right way to turn, of d glotice. Walls for literature.

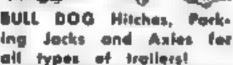
marker# \$3.96

HULL MFQ. CO. P.O. Hox 344-6-13. Warren, Ohio





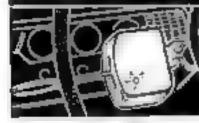




Write for FREE Catalog

Hemmer Blow Teel Company Wausay 14, Wisconsin

FLASH You



ELIMINATE HAND SIGNALLING L DIRECTIONAL SWITCH

The lowest priced Directional Switch that meets all 5.A.E. requirements.

Mare is a safe, comfortable way of signating your intent on to make a left or right turn. Flashes from 60 to 50 times per minute. No need to roll down window to signal turns is cold winter weather.

Kits furnishes with all necessary material for perfect insist stion. No outside mounting of any kind they your present parking and tall lights. Either of our two models this mounting.

Either of our two models fits most

Specify year and make of car, Money-back guarantee. A PERFECT CHRISTMAS GIFT

S & L AUTO SALES

Pactogo axtiru en

C.O.O. 's

FOR MOTORISTS Bax 4414, Dept. B, Chicago 7, III.



interchangeably. See this rifle at your dealer's. Operate its precision bolt action. notice the fine walnut stock, the simple dependable so/sty . . . all the features you recognize as extra value in this first quality, yet inexpensive, genuine

Long, Long Rifle cartridges

Winchester rifle.

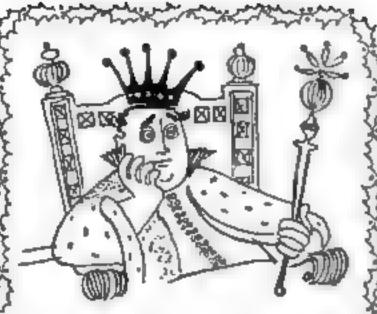


PRODUCT

The World Jamore Model 69

WINCHESTER

SPORTING RIFLE



For that man who has everything

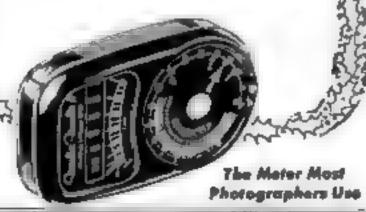
Does he have a Weston Expo-

Stills or movies—color or black-and-white—he'll get better shots every time with a Weston.

And if you're a camera user why not treat yourself to a Weston? At your photo dealer.

WESTON

EXPOSURE METERS



ELECTRICITY Anywhere

FOR PORTABLE, EMERGENCY OR HOME USE

ONAN Electric Plants furnish modern city-type electric service for hames, farms, cabine and resorts beyond the high-line. Lightweight, portable A.C., and D.C. plants serve contractors, estates, fire departments, etc. Automatic standby plants protect hospitals, radio stations, batcheries. Over a hundred models—400 to 55,000 watts. Gaseline or Diesel powered



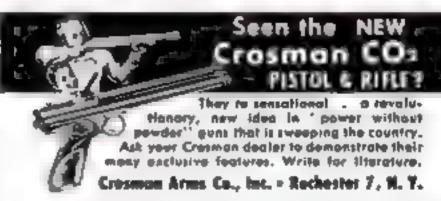
WRITE FOR CATALOG

D. W. ONAN & SONS INC.

2814 ROYALSTON AVE. . MINNEAPOUS S. MINN.

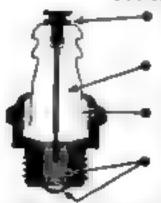






CHAMPION V-GLOW PLUGS

for model engines only



CHAMPION TERMINAL—assures better center electrode seal and provides sturdier electrical connection.

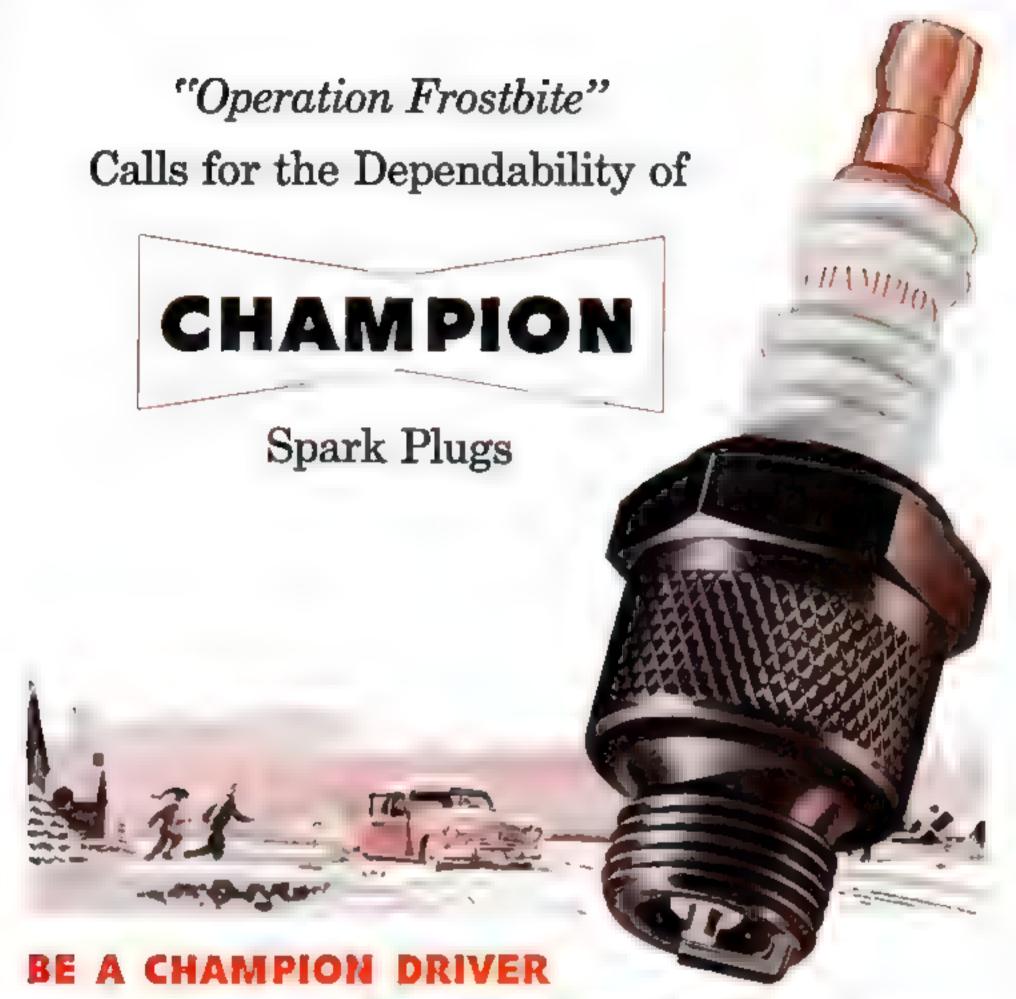
CHAMPION-CERAMIC INSULATORS proved dependable in millions of Champion Spark Plugs.

CHAMPION SILIMENT SEAL—prevents excessive compression leakage between insulator and shell.

CHAMPION "THREM-O-FLEX" CON-STRUCTION—longer element life, more dependable performance.

Follow recommendations of plug types and fuels approved by engine manufacturer.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, O.



... Keep Plugs Clean for Winter Starting!



Most service calls in winter involve cars that won't start. Dirt and oil accumulations on spark plug insulators often short circuit plugs under cold, damp conditions. Be sure to wipe off insulators frequently.



Plugadarty on the outside are likely to have carbon or oily deposits on the made at the firing end, causing hard starting and a wasteful engine. Have electrodes cleaned and regapped often. Heplace with new Champions when necessary.



Champion dealers are backed by the world's best spork plug engineers and equipment to give you top performance with Champion Spark Plugs. It pays to let them inspect your plugs frequently for full power and economy!

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO



R. J. Reynolds Toburco Company, Winston-Balem, N. C.

Say Merry Christmas to every pipe smoker on your Xmas shopping list or to any man who likes to roll his own cigarettes—with a big, full, one-pound tin of Prince Albert!

Choice, crimp cut, mild, flavorful tobacco-all ready for Christmas in a colorful, gift-packed Yuletide package... with a built-in gift card right on top!

Prince Albert

AMERICA'S LARGEST-SELLING
SMOKING TOBACCO

Popular Science Highlights this Month

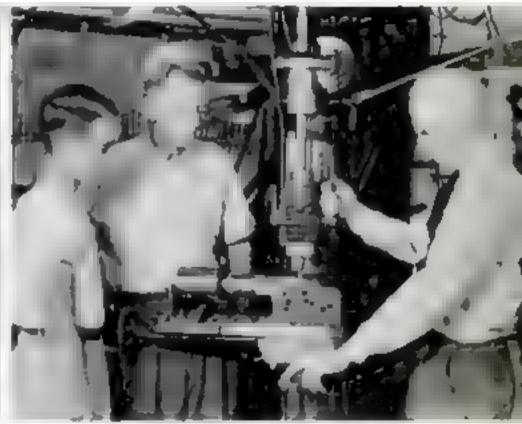


Are Yes Confused About Color Television? Then this low-down will help clear away the debris of TV's recent bombshell.

Page 116

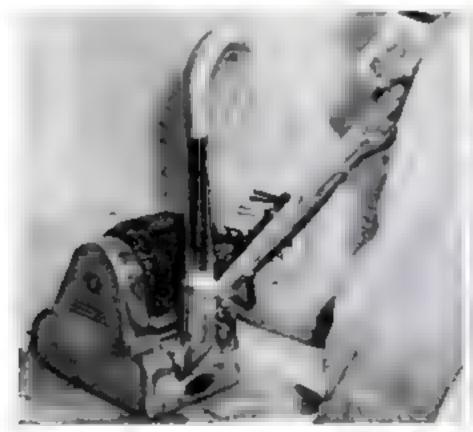


Outdoor Lights Spoil Merry Christman. This spotlighted Santa may be all you need, but if you want to get fancy, here's how. Page 261

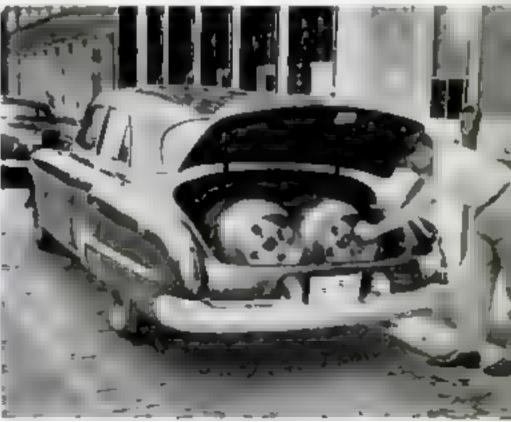


Uncle Sam Can Use Your Workshop. Here's a call to the hisement benefit and attn brigade to beland istry related America.

Page 186



Make Your Floors Look Like Mew. Follow these know-how tips, using rented machines, and you'll do a professional refinishing job. Page 170



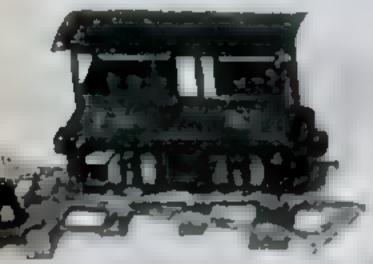
tr's Que, Not Beer. Those barrels are filled with LPG, a butane-propane mixture that's got more sass than high-octane.

Page 150



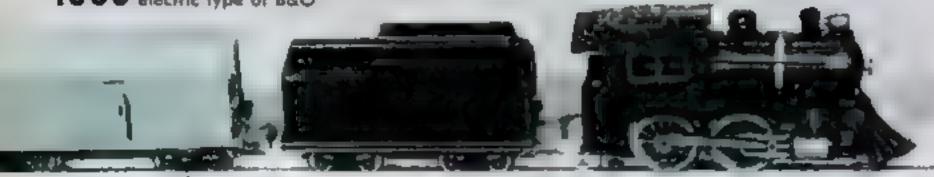
1900

Granddaddy of all toy electric trains, with motor beneath car at right, drew current from track of metal strips set in wooden ties



50th Christmas

1903 Early locomotive copied pioneer electric type of B&O



1907 large size of this toy train's engine and cars was typical of period. Train ran "on four good dry batteries," along "standard" three-rail track of wide 215-in gauge.



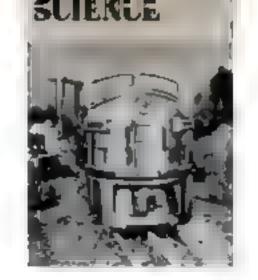
1915 Midget electric-type train was one of first built for O-gauge track, of 14-in width, which was introduced in this year and has become the most popular gauge today



1937 New high in accuracy was this copy of Hudson-type locomotive of the Twentieth Century Limited, a stock model precisely built to scale of one-quarter inch to the foot



Ingenious feats of remote control are highlights of half a century of progress as miniature railroading marks its Golden Jubilee.



for Electric Trains

By Aiden P. Armagnac PE PHOTOS BY W. W. MORRIS

CKILLED artisans of the Lionel Corporation, largest and oldest maker of toy electric trains, have turned out a miniature engine surpassing any night-before-Christmas dream.

It's a golden locomotive-a gleaming replica in precious metal, valued in hundreds of dollars, of Lionel's stock-model Santa Fe streamliner. Illustrated on this month's PS cover, it marks the Golden Jubilee of minuature railroading. It was a gift from the staff to the founder of the company, Joshua Lionel Cowen, who built the first toy electric train just 50 years ago.

You can't buy a golden locomotive, the writer was especially asked to add, lest anyone try-for there are model railroaders to whom expense is no object! What they can choose from though, should satisfy the most exacting 1950 fan.

Sleek streamliners whiz along a miniature right-of-way in a Lionel showroom, past automatic semaphores, winking block signals, and remote-control switches. Steamtype models belch smoke, and their whistles sound like the throaty wail of a big "hog" for a crossing at grade. Engines reverse and

tons. And, this year, there's a new refinement called Magne-Traction. Magnetized driving wheels enable all of Lionel's 1950 locomotives to climb stiff grades, and on level track to pull extra-long strings of cars.

Like many a major railway system, this one grew from modest beginnings. Its story is one of a series of inventions as ingenious, and patentable, as any in large-scale railroading. Probably the most fascinating thing about toy electric trains is their ability to do lifelike things without the touch of a human hand. And ways of muking them perform tricks by remote control account for a good part of Lionel's 170 patents.

Today a really rabid model-railway enthusiast would sooner grasp something violently radioactive than lay hands on a car to be moved or coupled. But even as simple a feat as starting and stopping a toy train with a distant control lever seemed like magic a half century ago.

Midget Motor Led to First Train

The year was 1900, trolley cars were still new-fangled, and railroads had just begun experimenting with electric locomotives, when Cowen built the first toy electric train. A young man of 20, he had perfected a miniature motor, which was being made for back up, take cars from sidings, and make battery-powered electric fans by his newly up a train, all at the touch of distant but- founded Lionel Company. Seeking more uses

Santa Fe atreamliner is one of today's Diesel types. Miniature engines and cars are 1950 Santa re atreaminer is one of today a blueprints, furnished to Lionel for this purpose.



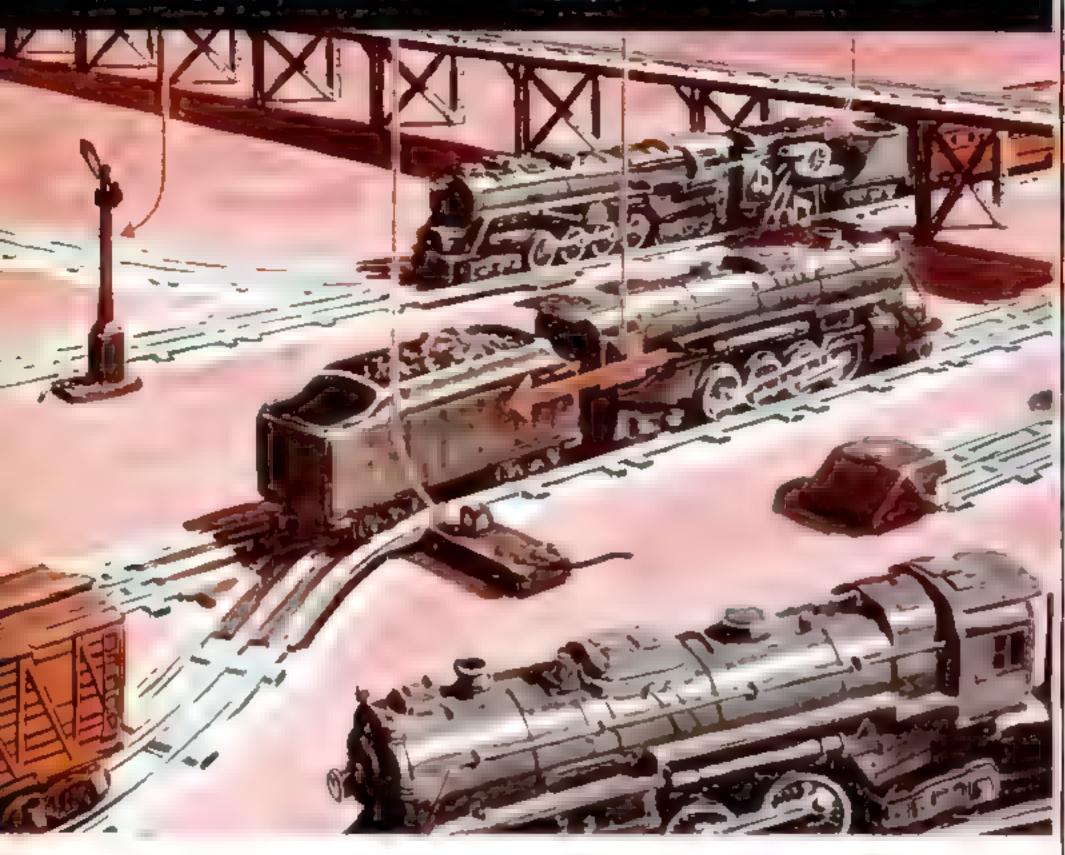
A Panorama of Progress in Miniature Railroading Reviews

phore, dates from 1921. 1926, somble operator have enhanced realism. It rises to "clear," to set distant switch by since 1926. So has anthen drops to "dan". Ricking an electric-con- 1 tomatic mechanical ger," as train goes by.

trol levet.

— coupling.

First automatic acces- ! Remete-control . Lecomotives that re-: Whisple, added to sory, electric sema- switches, introduced in verse by remote control tender in 1935, works by remote control. Realistic multi-tone sound summe to come from euwitte itself.



and customers for his motor, he hit on the dea of electrifying toy trains, of which the most elaborate were then windup clock work affairs.

His 1900 electric train consisted of a power car with his motor beneath, and a trailer car. Through its wheels it drew current from two-rail track, to which batteries were connected. The tracks were metal nbbons set in wooden crosstics. Wheels at opposite ends of a car axle were insulated from each other, preventing a short-circuit

Three-rail track came in 1909. Its central third rail conveyed current to the train, and outer rails were connected to form a single return path or ground. This dispensed with insulating the car wheels. It

also permitted more variety in track layouts. Track could curve back upon itself and join to form a \ without bringing the wrong outer rails into electrical contact First three-rail track was of wide 2%-inch "standard" gauge; in 1915 Lionel added the now-familiar 1%-inch "O" gauge. Toy trans formers had meanwhile replaced dry batteries to supply safe low-voltage power

Miniature railways were now blossoming out with glamorously painted accessories that worked-hand-operated or mechanically tripped signals, crossing gates with ringing bells. In 1921 the first automatic electric accessory, a semaphore, set a new style. Weight of an approaching train closed an electric switch beneath the track

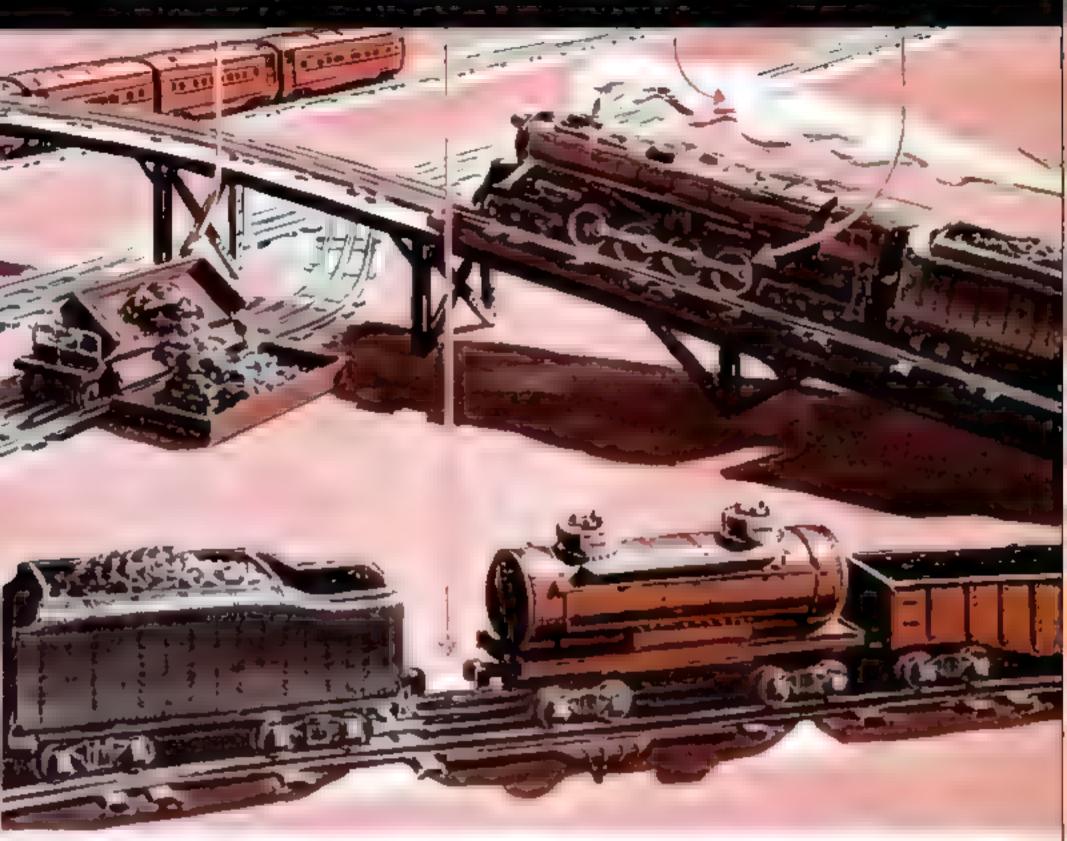
Some of the Most Ingenious of Lionel Innovations To Date

Plest electric "operat- 🖟 ing" car, a dump car introduced in 1938, tips and unloads coal when a remote-control button is pressed.

Uncompling by Te- Smoke, a 1946 refinework "operating" cars. it from stack.

mote control, another ment for locomotives, 1938 invention, em- is produced by electri-pleys same control— cally heated chemical track section used to pellets. Piston "pulls"

Magnetic traction, latest advance, enables all 1950 Lionel engines: to climb stiff grades, or pull more cars on level track.



and worked the signal electrically. Crossing gates and an "automatic gateman" now work the same way.

First big step forward in remote control came in 1926. Lionel had already brought out a track-attached tripping device to reverse a train. Now it introduced locomotives that reversed electrically anywhere on the track. The trick is done by a built-in sequence switch with four successive positions

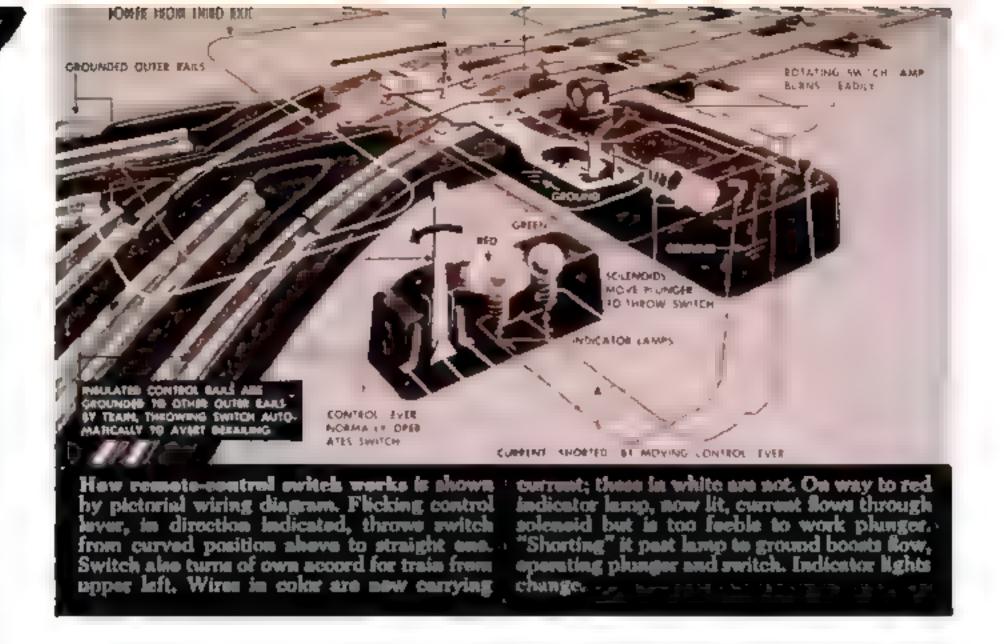
forward, stop, reverse, stop. Interrupt the track current by pressing a control button. and the rotary switch advances one step Pressing the button the right number of times thus evokes any desired response from the train

Remote-control switches, set by flicking a

distant control lever, were another 1926 innovation. An ingenious anti-derailing feature, automatically throwing any wrongly set switch to avert a wreck, was added to the remote-control switches in 1931.

A sound recording of a New York Central locomotive's whistle helped Lionel match it with a toy one, perfected in 1935 Installed in a miniature train's tender, it consists of a midget electric blower and a pair of flutchke pipes, whose tones merge into the whistle sound. A remote-control button sounds the whistle. How it works may well mystify the user, for the instruction book doesn't tell.

The secret is a little selenium-disk rectifier within the whistle controller. It feeds



direct current into the track, in addition to the alternating current that drives the train, when the whistle button is pressed. In the train's tender, this actuates a relay that responds to direct current only, and closes a circuit that blows the whistle.

Finding still other avenues of remote control was a problem when, in 1938, Lionel introduced self-unloading cars and automatic uncoupling. An acceptable compromise was to confine these operations to

sections of special remote-control track with extra rails. Pressing buttons made the auxiliary rails "live," and contactors beneath the cars drew current for their sole noid-operated mechanism. Newer mechanical couplers, replacing electrical ones, are magnetically operated by a coil in the special track.

Wired-radio operation of trains, a 1946 Lionel innovation, remains today the ultimate in remote control. Ten control but-



Magnetized locomotive truck chings even to upside-down track. Demonstration shows power of magnets used to improve traction by keeping engine's driving wheels from shpping.



Bars of magnet metal are inserted in miniature locomotive, which comes to worker on moving belt of assembly line in Lionel factory. At this stage, toy engine is nearing completion.

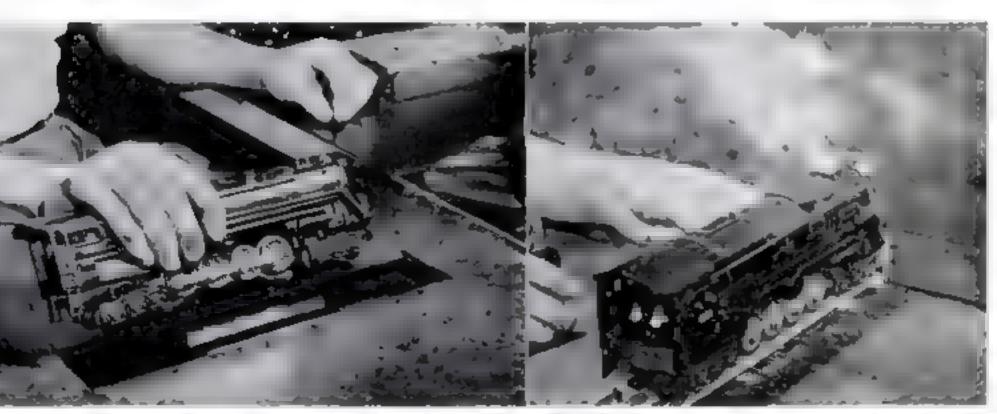


Endurance test is given five "automatic gatenien" by train circling track at Lionel plant. De-

vice has figure that emerges, waving lantern to warn motorists, as train nears crossing.

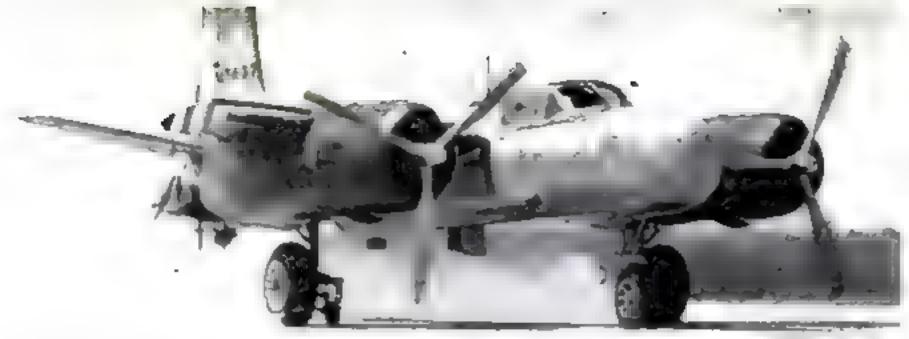
tons, on a one-tube transmitter, send radio signals of different frequency along the track. On the train, selectively tuned receivers reverse the engine, blow the whistle, and unload and uncouple cars anywhere. Moreover, the system will independently control two or more trains on the same track. Not surprisingly, such a train set is the most expensive in the catalog.

A resourceful model railroader, however, can make less costly equipment perform marvels. Block signals and insulated track lengths enable two trains to run on one track without colliding. Interconnected switches automatically vary the route a train selects, as if worked by an unseen tower man. Look at Lionel's instructions for stunts like these, and it may seem as if you'd need to be an Edison to connect up the wiring of a modern toy railroad. But don't be surprised if you come upon little Junior doing it successfully!



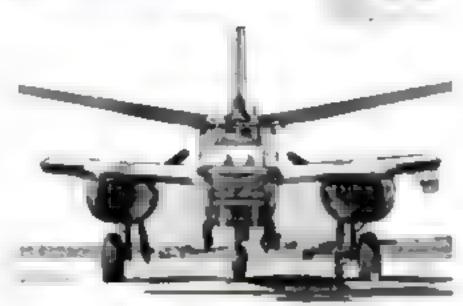
To magnetize inserts, worker places locomotive on pole pieces of electromagnet, which is energized for preset time by pressing button. Then engine goes back on assembly-line conveyer belt.

Finished engine gets running and smoke test on short length of track at end of the assembly line. Passing this final checkup gives it the "highball" to carton awaiting it.



"Wingless Wonder" Tests Landing Gear

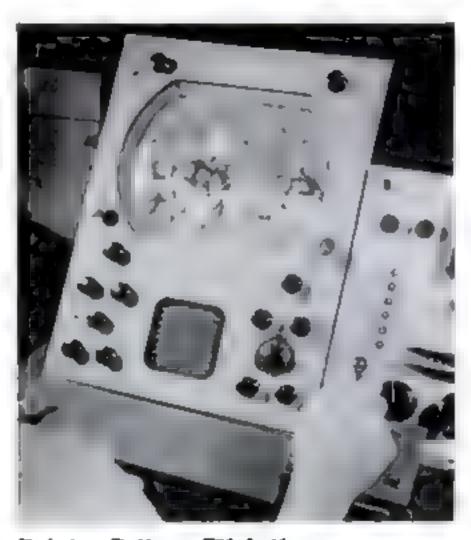
THE warbird above has had its wings clipped, but performs an important service to America's fighting forces. The "Wingless Wonder," a salvaged B-26, is used by engineers at Wright-Patterson Air Force Base for skidding tests to obtain data for the designing of better landing gear. Clipped wings (right) cut the heavy plane's lift as it hurtles down the runways at 150 m.p.h. to be braked to a full-skid stop.





Toy Building Units Snap Together

Inventiveness and imagination are the only limitations to the variety of toys the voungster above can build with his set of colorful Tenite plastic units that snap together with rustpmof fasteners. The geometrically-shaped pieces are said to be lightweight, chip-proof, sturdy enough to withstand rough play, and easily cleaned. Snap Blocks are made by International Molded Plastics, Ind., of Cleveland, Obio.



Pointer Follows TV Action

A TELEVISION commentator or announcer can now insert a black or white pointer anywhere in a TV picture so that you can more easily follow the action he is describing. As shown above, the GE Electronic Pointer is mounted in a chassis containing a monitor screen. Control stick at lower right enables him to shift the pointer smoothly. The device should be especially helpful to televiewers during sportscasts.

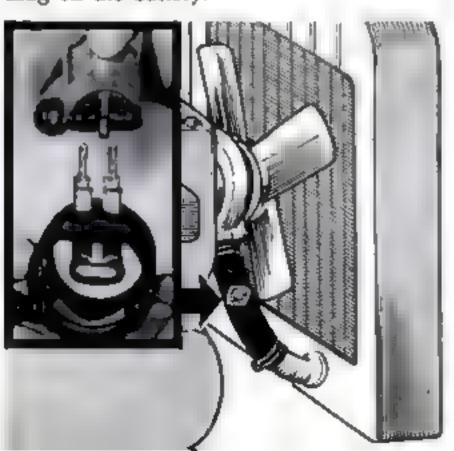


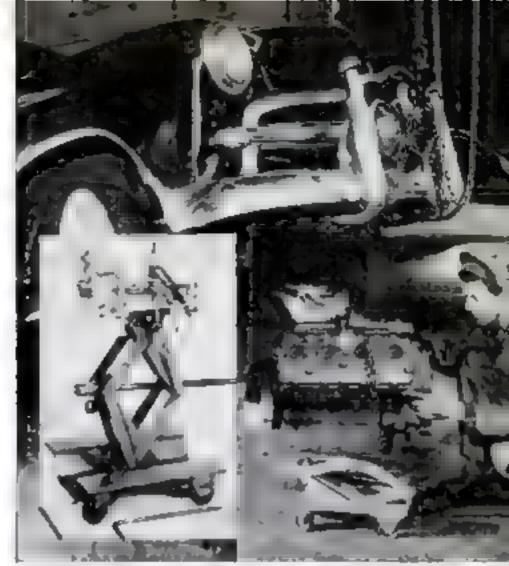
Steel Frame Converts Truck to Bus

An ordinary light pickup truck can be converted to a small bus in a few minutes with this one-piece tubular steel frame, which slides into the truck body. Light enough to be handled easily by one man (top), the Dixie Tallyho has three full-width padded seats. A heavy canvas top and side curtains give protection in bad weather. Alone, it is a beach cabana or lawn seat. Made by Dixie Tallyho, Inc., Fairburn, Ga.

Heater Aids in Cold-Weather Starts

This electric immersion heater for auto engines, developed by GE, is inserted in a small hole cut into a lower radiator hose. It pre-warms the coolant surrounding the motor block. The inset shows the two parts that clamp against the hose to make a permanent watertight joint. Plugged to an electric outlet for a few minutes on cold mornings, the Calrod unit reduces engine wear and cuts drag on the battery.





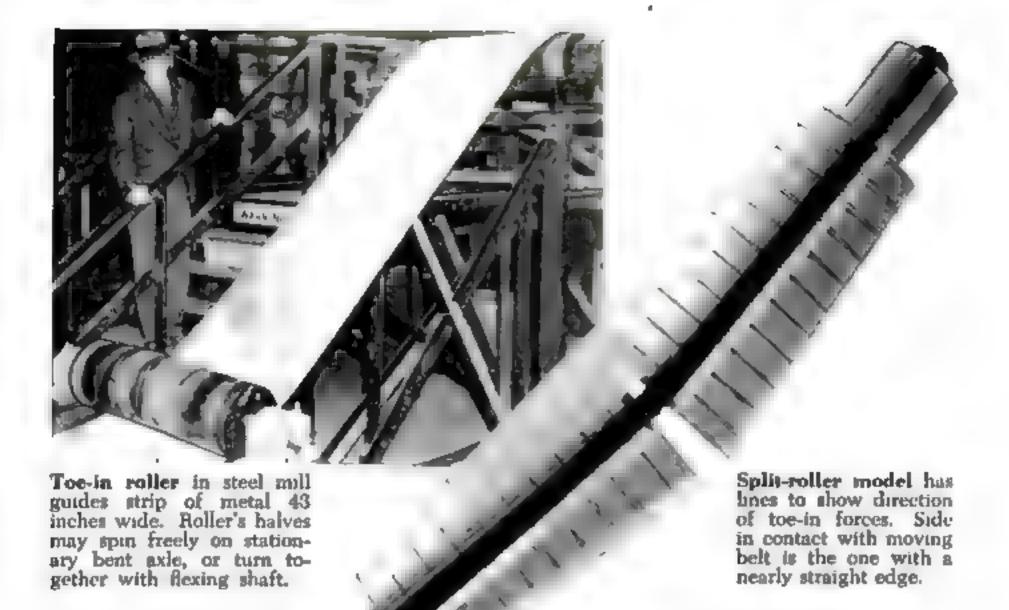
Jack and Dolly Unit Moves Heavy Parts

THE problem of both lifting and moving heavy auto parts is solved by this dual-purpose unit called the Pak-Jak, made by the Tow Bar Sales Co., of Chicago. The device consists of a screw-type scissors jack mounted on a dolly. It weighs 70 pounds and has various detachable adapter heads to suit engines, transmissions, and differentials. Above, it is carrying an engine into position. It can be used as a conventional jack.

Steel Mat Helps Snowbound Cars

THE flexible steel mat being placed under a car wheel below will help a driver out of ice and snow. Points of the wire rods holding the 16-gauge strips together project downward to give needed traction. One or more mats can also be used as a door shoe scraper and are easily cleaned by shaking them. Weighing 3% pounds each, they roll into a small size for storing. William F. Klemp Co., Chicago makes the Handimats.





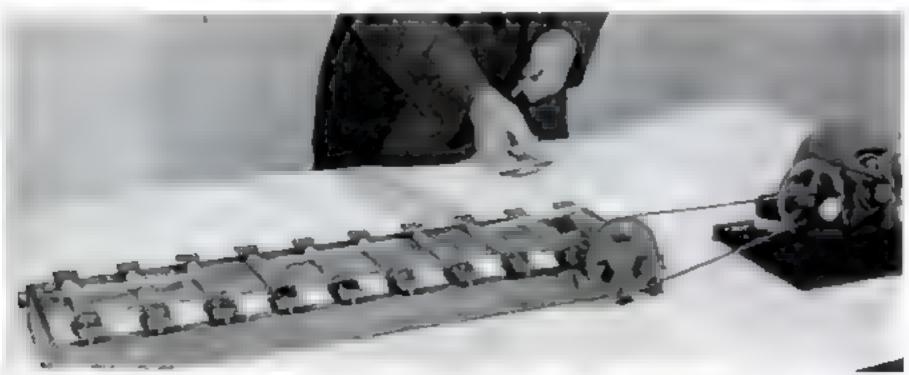
Roller Makes Belt Toe the Line

BELTS and strips of metal go straight when they pass over a new "toe-in" roller. Although it presents a flat working surface, the roller exerts a lateral force that centers anything in contact with it.

Since a belt won't slip off it, the roller has

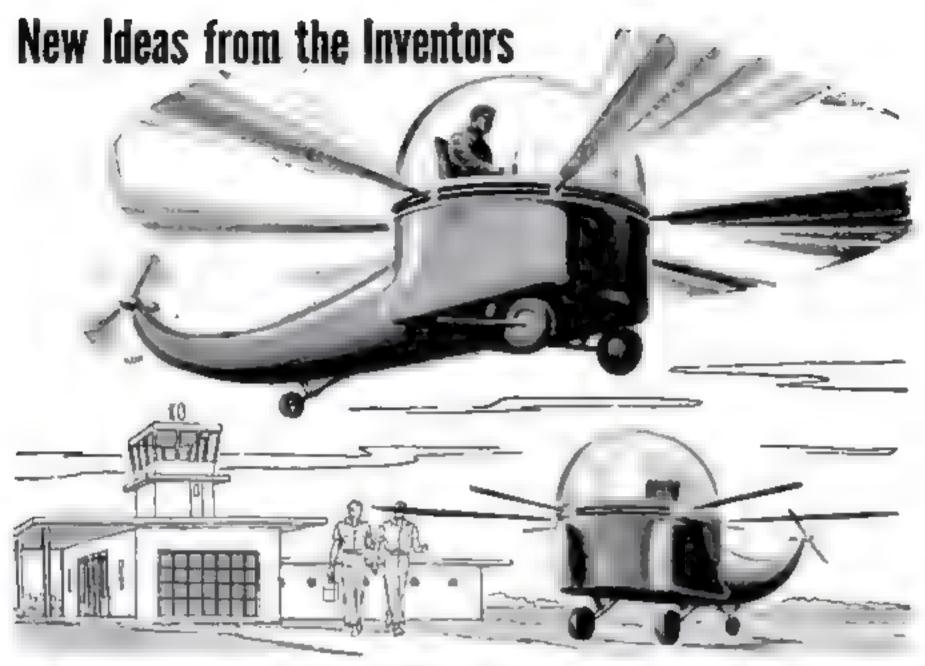
promise as a power-transmission pulley. In steel mills, it keeps a moving strip of metal aligned, averting damage to edges in handling. It permits such novelties as belt conveyers with metal belts, and roller conveyers that line up loose articles moving along a production line.

Invented by E. T. Lorig, U.S. Steel engineer, the roller is made of twin cones with axes askew, giving an almost straight working side. The cones' lateral friction shifts an off-center belt sideward-toward the center. then away, at each passage. Since the first effect is greater than the second, a net centering action results.



Dropped askew and off-center on twin rollers, pencils are automatically straightened and cen-

tered as they move toward left, in working model of roller conveyer using new principle.

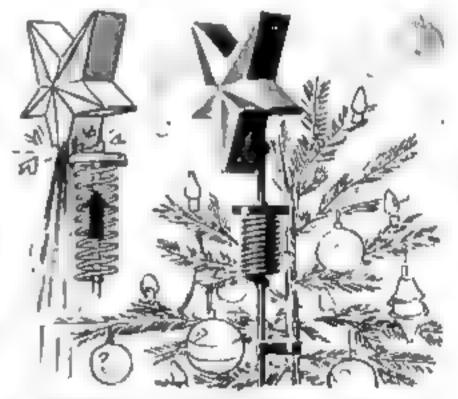


of windmilling above the fuselage, the blades of this helicopter would rotate around the cockpit. Besides providing better visibility and easier escape in case of an emer-

gency, it is claimed that this position of the blades, being nearer the aircraft's center of gravity, provides improved stability and control and allows more blades to be used to provide greater lift.



2 Blower to Remove Sawdust. Acting like an air scoop, this device attached to the side of a handsaw handle blows away the sawdust that drops on the saw line during the backward stroke. Air entering the scoop on the forward stroke of the saw is directed, through a tapering, curved passage, downward toward the wood.



3 Christmas Star to Douse Fire. Designed for the top of a Christmas tree, this star filled with fire-extinguishing fluid serves as a safeguard as well as an ornament. A spring trigger, normally held in a cocked position by a fusible element, is released if the tree catches on fire. This breaks the star, spraying the tree with the liquid chemical.



4 Swing Guide to Train Golfers. A golfer using this training device can't do anything else but execute a perfect full swing. The head of the club, riding in a longitudinal slot, is guided throughout the entire

swing. A chart or mat on which the golfer stands shows the correct foot positions that should be used with each of the various types of golf clubs. Balls are placed on the tee and can be actually hit.



5 Vacuum Cleaner to Burn Dirt. Dust and dirt sucked into the tank of this portable vacuum cleaner would be passed over a hebically shaped white-hot electric element and burned to ash. The ash drops down into a collecting receptacle and the air is passed through a charcoal filter to remove all odors before being exhausted.



6 Snow Scoop to Save Stooping. A second handle, consisting of a wire loop fitted with a grip and attached to a snow scoop with a cotter pin, makes it easy to shovel snow without back-bending. The wire, free to slide through the eye of the cotter pin, allows the shovel to be maneuvered or turned as desired.

Patents on these townstians have been granted to: 1 M. Baten, Brooklyn; 2. I Landien, Gary Ind. 2. H. Leon, Brooklyn; 4. I. Plankett and E. Dorso, Niagara Falls, N. Y., 5. L. Deye, Learnion, Idaho, G. L. Bickley, Bate Cynnyd, Pa.

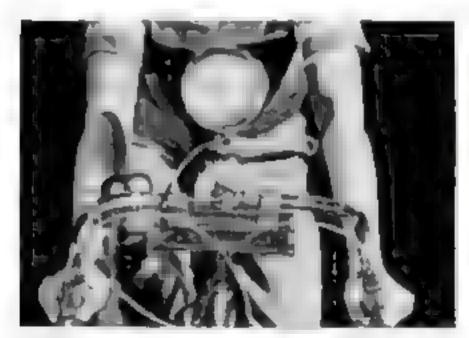




Power-Line Insulators Cleaned by High-Pressure Water Jets

THE man in the crow's nest above is busy giving the insulators of Southern California Edison Company's high lines their regular washing behind the ears. Dressed in oil-

skins, a lineman blasts dirt away with highpressure jets from a 700-gallon tanker. Dirty insulators may break down electrically under voltage surges.



Bike Gets Block-Long Light Beam

This new Westinghouse bicycle lamp throws a beam of 5,000 candlepower. Patterned after sealed-beam automobile headlight, it operates on either three or six flashlight batteries. Lamp costs \$1.75; mounting brackets and battery case are extra.

Altitude Affects Eyesight

ONE FIFTH of the people living in a town more than 15,000 ft, above sea level in the Andes have been found to have only two-thirds normal vision. Dr. Jorge Valdeavellano, of Lima, Peru, reporting to the Third Pan-American Congress of Ophthalmology, laid the blame for this deficiency on enlargement of blood vessels.



Rockets Release Anti-Red Leaflets

THE tub-like object above is the latest weapon in the Cold War—a propaganda rocket. A young German is about to fire it over the border into the Soviet sector of Berlin. A double explosive charge first sends it flying hundreds of feet in the air, and then blasts it apart to min anti-communist leaflets upon Red territory. A thousand leaflets can be packed into the six-inch diameter of the two-foot tube.



Shaw Drives the New

Trying out this long-heralded automatic drive, a gear-assisted torque converter, Shaw says it's the best on the road,

By Wilbur Shaw

EDITOR'S NOTE: This month POPULAR SCIENCE's automobile reporter sneaks you through the guarded gates of the Ford proving ground for a preview of the newest automatic drive.

BACK in 1948 the Ford people bobtailed their engine—they began casting the bell housing separately from the block. It was a tip-off they had other changes in mind.

They did. It's here now. Ford—and Mercury, too—for 1951 have those long-awaited automatic transmissions. Bobtailing the en-

gine was just to get ready for a torque converter in place of a clutch.

They're optional, these new transmissions. You pay extra. Whether you'll be willing to depends on whether you react to this new transmission as I did.

Now, I may as well admit that I'm prejudiced when it comes to these automatic drives. I got rid of one car largely because I didn't like its do-it-for-you transmission. It would shift when I didn't want it to, and wouldn't when it should. In preference to some of these newfangled drives, give me the old low-intermediate-high shift lever any day. They keep telling us that automatic transmissions simplify driving. I question this, at least under some conditions.

I was delighted when I was invited to Dearborn late last summer to try out the new Ford-Mercury drive. First off, I went to see my friend Harold Youngren, the company's vice-president of engineering. The

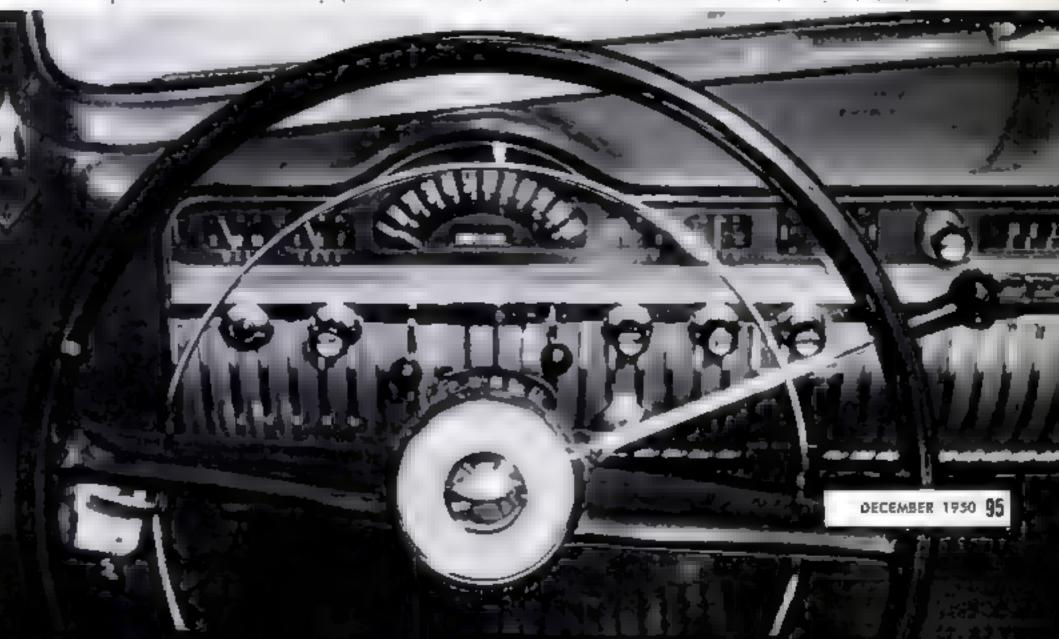


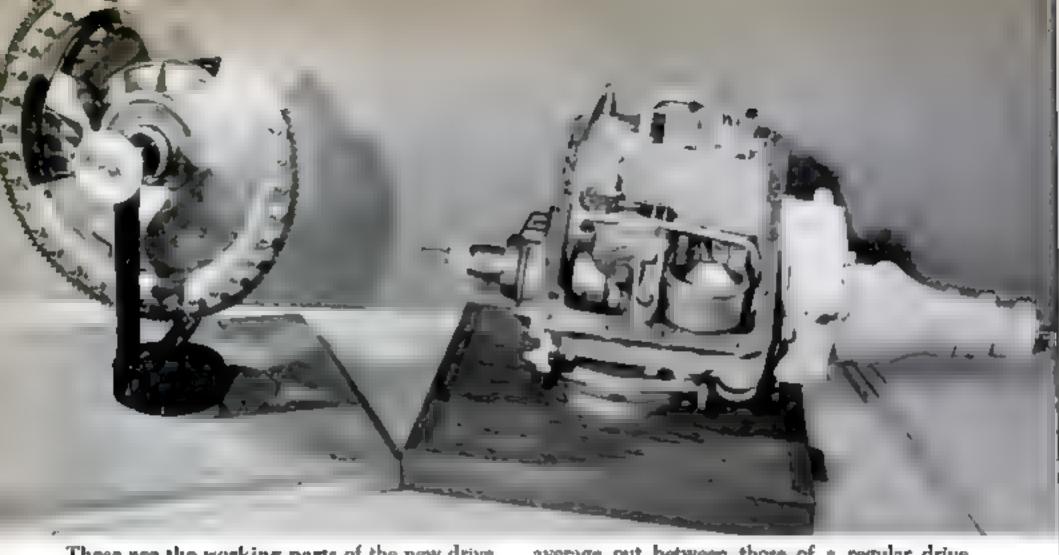
I rolled the new Ford-Mercury automatic transmission on the proving ground "fast track" in that '51 Mercury to see Low it would act compared with the standard three speed gearbox

Ford-Mercury Transmisson

The arrangement of positions on the selector quadrant of the Mercury (and the Ford too) is

different from that of other automatic-drive





These are the working parts of the new drive. At the left is the torque converter, cut away, at the right, the gear box. The converter is air-cooled. Actual engine revolutions per mile

average out between those of a regular drive and overdrive. The rear-axle ratio for both Ford and Mercury is 3.31.1—as against 3.73 and 3.79 respectively with a regular transmission.

new transmission is Harold's baby. He started working on it at Borg Warner years ago and his labors have now borne fruit. He explained how it worked, and it was obvious he is proud of it.

The Ford-Mercury drive is sort of half-way between Packard and Studebaker on one hand and Buick and Chevrolet on the other. Like Packard and Studebaker, the Ford-Mercury transmission has a torque converter that is gear-assisted some of the time when the selector lever is in the Driving Range position. This intermediate gear, used most of the time from a standing start, helps the torque converter get the car under way. But it slips out of the power train as



Benson Ford, who heads the Lincoln-Mercury Division, is mighty proud of the new drive. He's on the right in this picture, taken when he paced the 500-mile race in a 1950 Mercury.

the car gains speed. For more zip on a hill or in passing, you can kick the transmission down into intermediate at anything below 58 m.p.h. And like all these new torque-converter drives, the Ford-Mercury also uses gears for low and reverse.

Torque Converter Not Locked Out

The Packard and Studebaker converters lock out of the power train at certain speeds. The important difference in the Ford-Mercury drive is that, whether the converter is acting to multiply torque or as a fluid coupling, it's always in the power train.

That makes it somewhat akin to Buick and Chevrolet. But there's a difference there too. Buick's Dynaflow and Chevrolet's Powerglide do not have a gear-assist for the converter in driving range [PS, April '50, p. 98].

It seems to me that Ford-Mercury has incorporated the most desirable features of all the automatic transmissions I know about. It's a smooth, well-engineered job.

From Harold's office I went to the track. This is on the old Ford airport, which has been converted entirely to proving grounds. Most of the track is fairly flat, but one of the curves is banked for 90 m.p h.

My first mount was a Ford Six with the new transmission. I was glad that a six was available. It would be new to me. I climbed into the left-hand seat and turned on the re-



The first picture with this article shows my left foot on the brake pedal. Here's a close-up of the extra-long pedal. A lot of drivers will use that left foot, especially in parking.



Here's the underside of the drive. The left arrow points to the air intake for cooling the converter. The right one points to the air outlet. The transmission holds 9 quarts of oil,

cording machine I use to wax my impressions during a drive. Here are my comments:

You can start the engine, with this new transmission, in only one position of the xelector lever. That's in neutral. That's akay . . . a good safety provision. You could get yourself into trouble otherwise.

I like the arrangement on the selector quadrant. It's different from the rest. Neutral's in the center. Reverse is to the left of that. It'll be easier for the average motorist to get used to the position of the lever in reverse. It matches the position of a conventional lever.

This shift is hard. It's a good deal harder than in a regular transmission. Maybe it's just this car, and the production jobs will be different.

With the selector lever at drive, I eased down on the accelerator and began rolling along a broad strip of concrete.

Well, you can't deny it . . . this transmission is smooth. With light accelerator pressure, you can go out of intermediate into "high" at about 17 miles an hour . . . but you can stay in intermediate . . . you can keep it from shifting . . . clear up to almost 60. Just tromp on it, that does it.

I kept starting and stopping, feeling out the acceleration and trying my best to detect the point where the intermediate gear let go. I can get the transition now ... I can feel it going ... from intermediate into high ... hut you can just barely feel it. It's that smooth.

I honestly believe this is the smoothest acceleration I have ever experienced from zero to cruwing speed. Now we're coasting. Foot off the accelerator. We're slowing down. There! She slips into intermediate at about 5 m.p.h. And I mean slip. Hardly perceptible.

Kicking It Doson Isn't Necessary

I wheeled onto the fast track. By this time I was beginning to like the fast acceleration qualities of the converter-plusgear. I also was beginning to understand what Harold Youngren meant when he said that keeping the converter in the power train gave this transmission a lot more flexibility. You didn't necessarily have to hit the accelerator hard, striking a button undemeath on the floor, as you do to get out of overdrive, to get a burst of speed. The instant you open the throttle, the converter begins giving you more push. Yet you can throw the gear part of the transmission back into intermediate for even more torque by depressing to the button if you want to.

You get performance, all right, but I wonder what it costs in gasoline. It must be plenty.

I was wrong. The word I get is that gas



Harold Youngren told me, "I'm perfectly satished that a lot of people are going to drive this transmission for the entire life of their cars without once shifting into low range."

mileage averages better than with a standard gearbox, but not quite as good as with overdrive.

We're doing 55. Now I'm going to pull the selector lever into Low Range. Such procedure can create havoc with some transmissions. This one reacts heautifully. Just normal fast deceleration . . . That's good.

The gimmick is that shifting into Low Range at that speed puts you, not into low, but intermediate.

Low-Range Protection Is Automatic

Now I'm getting it. At about 30 miles an hour, as you decelerate, the shift into Low Range does occur. If the shift from high to low at speed wasn't delayed by the automatic intervention of intermediate gear.



They're steel workers. A monkey is steel workers' lingo for a tap hole for drawing off stag from a blast furnace.

it would pitch you into the windshield . . . what a beautiful piece of engineering!

You need Low Range . . . there are times when you need extra braking power in going down hills, or more comph in going up. Still, you'll rarely use it.

Engine braking effect is on the debit side. The braking effect, compared with that from a conventional transmission, leaves something to be desired. But that is characteristic of all these new torque converters. And it is not a serious factor.

I wanted to try out the transmission in sand, and I left the track to drive to the Ford heavy-going course. When the car was thoroughly bogged down, I tried rocking it.

This isn't so good. You have to cross through Neutral to shift back and forth between Drive and Reverse. That takes some doing. I'll have to revise my estimate of the positions on the quadrant. This car is hard to rock. You might have your troubles . . . getting out of snow, sand, or mud. But you're supposed to stay out of that kind of trouble.

In a 1950 Mercury body on a 1951 chassis, I left the proving ground to do a little driving in traffic. In hard stop-and-go driving through Dearborn the transmission proved to be everything the Ford people claimed for it. It would seat like a cat when you hit the accelerator.

A Little Creep

This engine idled a little fast and the car had a tendency to creep. I had to keep my foot on the brake pedal at a stoplight. But with practically any of these new transmissions, you can't have all this and Heaven too. Cive Studebaker credit. They've whipped that creep problem.

But creep or not, I'm going to stick my neck out on this new Ford-Mercury transmission. And get into a peck of trouble with partisans of the other automatic drives. Nonetheless, it's my considered judgment that the Ford-Mercury drive is the best of the lot. It paces the field,

This Month's Shaw-ism

The driver who is as courteous in his car as he is in the boss's office hardly ever gets into an accident.

Kilm Sha



Wing Tanks Increase Bomber's Range

Fuer, tanks mounted on the wing tips of this North American B-45C jet bomber give the plane a longer reach, increasing its former 800-mile radius. The nacelles of the engines and the tanks are painted black to reduce glare in the pilots' eyes. The bomber can carry more than 10 tons of bombs at a speed of 550 m.p.h.



Milk Cooler Is Eagler to Load

A NEW kind of milk cooler is taking some of the load off farmers' backs. It opens from the front so that 110-lb. milk cans need be lifted only 11 inches. With old-style, topopening coolers, the cans must be raised three feet to be dunked in cold water. The Westinghouse cooler sprays 25 gallons of water a minute over the cans, chilling milk from 90° to 45° in 1% hours.



Flying Lab Coats Itself with Ice

The jungle of pipes attached to the side of this C-54 flying laboratory helps engineers at Willow Run Airport to test aircraft de-icing equipment aloft. Nozzles on the pipes spray ordinary water, in the form of rain, snow, or fog, on the plane. In freezing altitudes the spray becomes a coat of ice. Despite its size, "Squirtin' Gertie" doesn't produce much drag on the plane.



Light is Strong Enough to Read By a Mile Away

Even a mile away, the light from this new portable searchlight is so bright you can read a newspaper by it. Fitted with a 200-watt, sealed-beam lamp, it plugs into an ordinary 110-volt socket. The searchlight has an adjustable stand, and is useful to farmers, mechanics, and others both for area illumination and making night repairs. Unity Manufacturing Co., of Chicago, also make other models that use 6-, 12-, or 32-volt power and have plugs for automobile or marine use.



Converted LCT Repairs Highway Bridges

THE converted Navy LCT (Landing Craft, Tank) above is busy cutting bridge maintenance costs for the South Carolina Highway Department. Stripped of its superstructure except for two deck houses, the

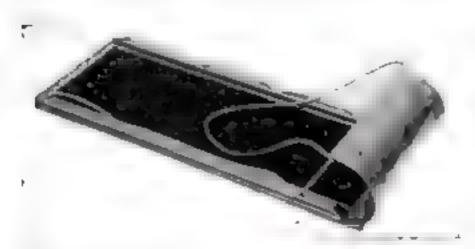
vessel was rebuilt with a level deck. Timbers and pilings are handled by an old 20-ton steam locomotive crane mounted at the bow. The craft has three Diesel propulsion units and a Diesel-driven motor generator.



Taped Wool Tufts Test New Automobile's Contours

Before incorporating final design changes in the new Type 401 automobile, engineers of the Bristol Aeroplane Co., of Britain, took a tip from their aircraft division and taped tufts of wool all over the body of an experimental model. Photographs taken as the car

was driven through its speed range determined the direction of air flow over any point on the body and gave a visual check of aerodynamic efficiency. Results: cleaner bumpers, swept-under side panels, and repositioned lights.



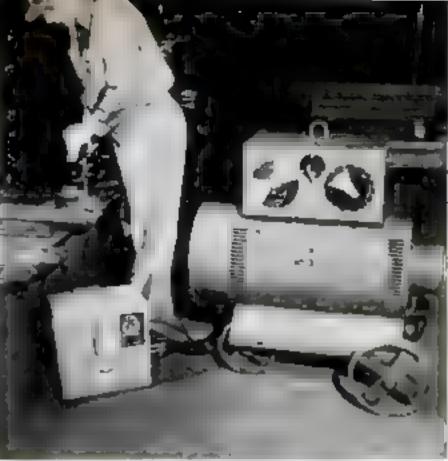
Aluminum Toboggan Is Light, Tough

MADE of heavy-gauge aluminum, this new junior toboggan (left)—3% feet long, 16 inches wide—weighs only 7 pounds. Flush rivets leave the bottom smooth for a fast ride over snow, sand, or grassy slopes, and the flexible bow doubles as a bumper. The Duraboggan is made by Duratech Mfg. Corp., Tarrytown, N. Y., to sell for \$10.95.

IND POPULAR SCIENCE



Casement windows are bolted to lintels by studs quickly welded in place. Power source in foreground is battery-operated, has its own charger.



Motor-generator, above, is used where power is available, delivers as much current as two conventional 400-amp, generators in parallel.



Ceiling fixtures will hang from these study welded to channel-type flooring. Gun is also handy in replacing broken or sheared bolts.

Stud-Welding Gun Speeds Building

Tais welding gun, holding a stud up to X inches in diameter, is pressed against a steel beam. When the trigger is pulled, the stud is quickly and strongly end-welded in place. Designed by a shipyard worker during the war, the Nelson stud-welding gun helps builders in mounting window frames and holding plumbing fixtures. In the new UN building in New York City, it's estimated that the use of welded studs to fasten the floor-to-ceiling windows eliminated drilling and tapping 50,000 holes in steel beams.

Dashboard Lights Reveal Car Battery Condition

A NEW device that is bolted to the dashboard instantly tells a driver the exact condition of his auto battery. With the unit on, the driver presses the starter button. If all three lights on the unit (inset) light up equally brightly, the battery is in good condition. If one or more lights are dim, it shows which battery cells need attention. Flickering lights mean low water level.

Detecto-Cell is sold for about \$6 by the Mynatron Corp., of Pontiae, Mich.





You Wouldn't Know The Old Bug Bomb

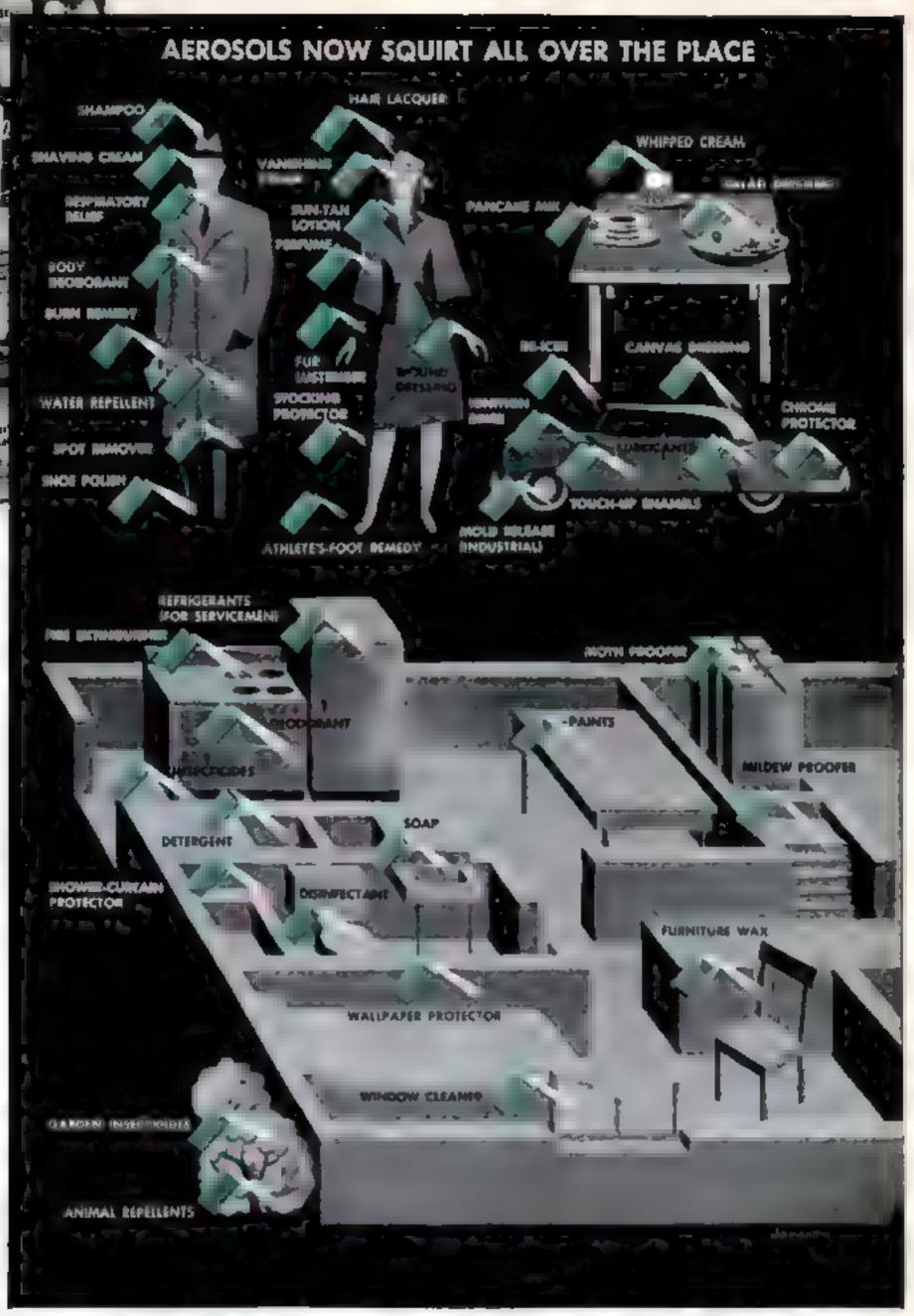
Modern pressure cans squirt everything from shaving soap to shoe polish, from paint to pancake batter.

By Sheldon M. Gallager

THE bombs that put the blitz on bugs for our GIs have gone to work at home. Called aerosols, these pressure-powered, push-button dispensers are being recruited to do an increasing variety of peacetime chores, saving time, work, and money. Fitted with tiny valves and purpoint nozzles, they

now spray out everything from perfume to shoe polish at the touch of a trigger. Other containers, fitted with slightly different valves, squirt out pre-foamed globs of shampoo, shaving soap, whipped cream—even pre-mixed pancake batter, ready to fry.

The onginal bomb was well named. A high-pressure, heavy-walled steel container, packed with gas at 70 pounds, it looked like a bomb, was heavy enough to be one, and cost from \$3 to \$4, with refills for about \$2. Now you can get low-pressure, disposable dispensers, operating at 40 pounds or less, at half the cost. A 12-ounce can of DDT,



From attie to cellar, garden to garage, there is scarcely an area in the home, as the drawing above shows, that has not been invaded by the modernized bug bombs. Doctors, too, can now

look forward to germ-killing wound dressings, surgical scaps, adhesive-tape removers—even local anesthetics. Also in the works are specialized sprays for industrial uses.

equivalent to 2½ gallons of spray-gun insecticide, costs as little as 98 cents.

The new low-pressure container, made of lightweight timplate, is essentially a beefed-up beer can. In fact, the normal pressure in a beer can at room temperature, or 70° F., is actually greater than that in an aerosol container at the same temperature. Only at higher temperatures, above 130° F., do aerosols begin to outpush beer, requiring a stronger container. Continental has one with heavier walls than a beer can, concave top and bottom, and a special interlocking side seam. Crown Can, working on its own, has developed a one-piece, drawn dispenser that eliminates all seams but the bottom one.

The gas, put into the containers under refrigeration to keep it liquefied, serves a double purpose. Part of it remains in solution, dissolved in the liquid concentrate to be dispensed, while part of it vaporizes, filling the headspace between the concentrate and the top of the can. The gas above the concentrate serves as a propellant to force the liquid up a siphon tube and out through a fine jet. At this point, the gas still in solution takes over to finish the job. Expanding rapidly as it leaves the nozzle, it blasts the liquid concentrate into an ultrafine, mistlike spray.

In the foam-type products, like shampoo

and whipped cream, the principle is the same, but the effect is slightly different. The gas particles trapped in the concentrate expand as they leave the nozzle, whipping the liquid soap or cream into a fluffy lather. Large nozzles, instead of pinpoint jets, keep the foam from becoming a spray.

How Pressure Is Determined

The pressure inside an aerosol container is determined not by the amount of gas put in, but by its vapor pressure. This is a property of the gas itself and varies with each kind used. At any given temperature, it is the pressure at which the gas in the head-space of the can condenses back into liquid form just as fast as the liquid gas vaporizes. At this point, evaporation and condensation balance each other, and the pressure remains constant.

Each time you use the can, you let out some of the liquid, increasing the headspace and causing a slight drop in pressure. But as the pressure drops, it lets more of the liquid gas evaporate, filling the increased head-space and building the pressure back up again. Thus, the pressure always remains the same whether the can is full, half full, or down to the last drop.

Aerosols, though they have become the name for all pressure-propelled products, are



Strong, seamless container, made by Crown Can Co., starts out as shallow pan (top left), is drawn by successive stampings into tall, nar-

row can. Then neck is formed and top is cut out for valve (bottom row). Finally, concave bottom is attached and label is lithographed on.



True nerosols, like insecticides (left), produce fine mist that hangs in air. Surface coatings, like car wax (center), produce coarser, wetter

sprays, are called surfasols. Foams, like whipped cream (right), have larger nozzles, lugher pressure, are called aerated products.

actually only one of three basic types. True acrosols, like insecticides and room deodorants, produce a fine mist designed to hang in the air a long time before settling. Paints, polishes, and similar coatings, intended to cover a surface rather than hang in the air, are produced by coarser, wetter sprays and are called surfasols. The foams, not sprays at all, are called aerated products.

To get exactly the right spray or foam, the pressure of the gas used must be carefully tailored to each type of product A pertume spray, for example, must be coarse enough to form a film like a surfasol, vet nearly as fine as an aerosol to avoid drenching its user. Too little pressure, failing to break up the particles finely enough, could turn the desired mist into a shower bath. And because a perfume depends for its overall odor upon the order in which its various ingredients volatilize, too much pressure, changing that order of volatilization, could actually after the perfume's scent.

In most cases, the thicker the liquid to be dispensed, the higher the pressure required. Filling techniques vary with each manufacturer, but a typical pressure for true acrosols, thin in consistency, is around 25 pounds. The thicker surfasols average 35 to 38 pounds, while the foams require at least



Beer-can-type dispenser, made by Continental Can, begins as flat sheet, is then bent into cylinder. Cutaway can shows siphon tube, angled

to get last drop. Note concave top and bottom to withstand pressure. Special side seam interlocks like Indian grip, takes 300 lb. pressure.



At packaging plant, cans are filled under refrigeration to keep gas liquefied so it can't escape. Twin dispensing tanks, chilled to -30° F., squirt gas and concentrate into cans as they pass on conveyer at up to 60 a minute. Cans

are quickly capped by machine in background, then tested for leaks at 130° F, where pressures hit up to 150 lb. per sq. in. Bostwick Laboratories plant above, in Bridgeport, Conn., alone turns out over 100,000 aerosols a day.

40 pounds and, in some cases, much more. The original high-pressure bombs were charged with du Pont's Freon 12, an inert, non-inflammable, relatively non-toxic liquefied gas that vaporizes to produce a pressure of 70 pounds per square inch at 70° F. With the development of low-pressure aerosols, the straight Freon 12 was diluted with Freon 11, a similar but lower-pressure gas. By varying the proportion of Freen 12 to Freon 11, the pressure of the resulting mixture can be custom-tailored to each type of product to be dispensed, A 50-50 mixture produces a pressure of about 35 pounds at 70° F. A mixture of 70-percent Freon 11 and 30-percent Freon 12 lowers the pres-

Newest gases to be used are General Chemical's recently developed Genetrons. Similar to Freons, they come in half a dozen ready-made pressures to give aerosol makers a wide choice. Food products, like whipped cream, use a combination of nitrous oxide and carbon dioxide because they are odorless, tasteless, non-toxic, and have a high degree of solubility in cream concentrates.

sure to about 25 pounds.

In general, for a concentrate of a given consistency, the higher the pressure, the finer the spray, and the lower the pressure, the wetter the spray. But the amount of gas, in relation to the amount of concentrate, can also affect a spray. A spray that contains a high proportion of gas will tend to be finer than one with a low proportion, since the presence of a greater amount of gas breaks down the particle size.

The size of the valve opening can also affect a spray, but until recently most valves were standardized, with thick paints and thin insecticides coming out of the same nozzle. Now aerosol makers are beginning to fit the valve to the product as carefully as they do the pressure of the gas.

An All-Class Aerosol?

With 30,000,000 aerosols made in 1949 and an expected 50,000,000 for 1950, tomorrow's squirt bombs promise even better things to come. One may be an all-glass dispenser, if manufacturers can develop an unbreakable container that won't shatter under the pressure or blow up if it's dropped. Besides eliminating corrosion, claim aerosol experts, it would look better and let you see exactly how much you have left.

Already, the versatile bombs-of-all-trades have turned up as paints, polishes, cleaners, mothproofers, deodorants, cosmetics—and a disposable blowtorch. There are even sprays to dry out your spark plugs, cure your athlete's foot, protect your silk stockings, and keep neighborhood dogs away from your prize shrubs. Tomorrow you'll be squirting mayonnaise on your salad, meringues on your pie, maybe even catsup on your meat

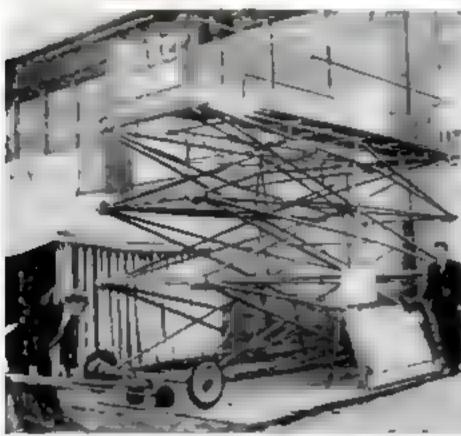
And for the guy who started it all, the mud-slogging foot soldier, there will soon be a pocket-sized, push-button smoke bomb to give him his own personal smoke screen whenever he needs to take cover.

END

See Popular Science next month for tips on using new spray-paint bombs in your home.

Folding Scaffold Rises 46 Feet

Invented by a Munich tinsmith (who is shown below adjusting the unit's front wheel), this seissors-type steel scaffold folds down to less than 10 feet. A small electric motor quickly raises the working platform to a maximum height of 46 feet (right). The movable, tubular-steel scaffold weighs a little more than a ton.





Crooked Bar Does Many Bending Jobs

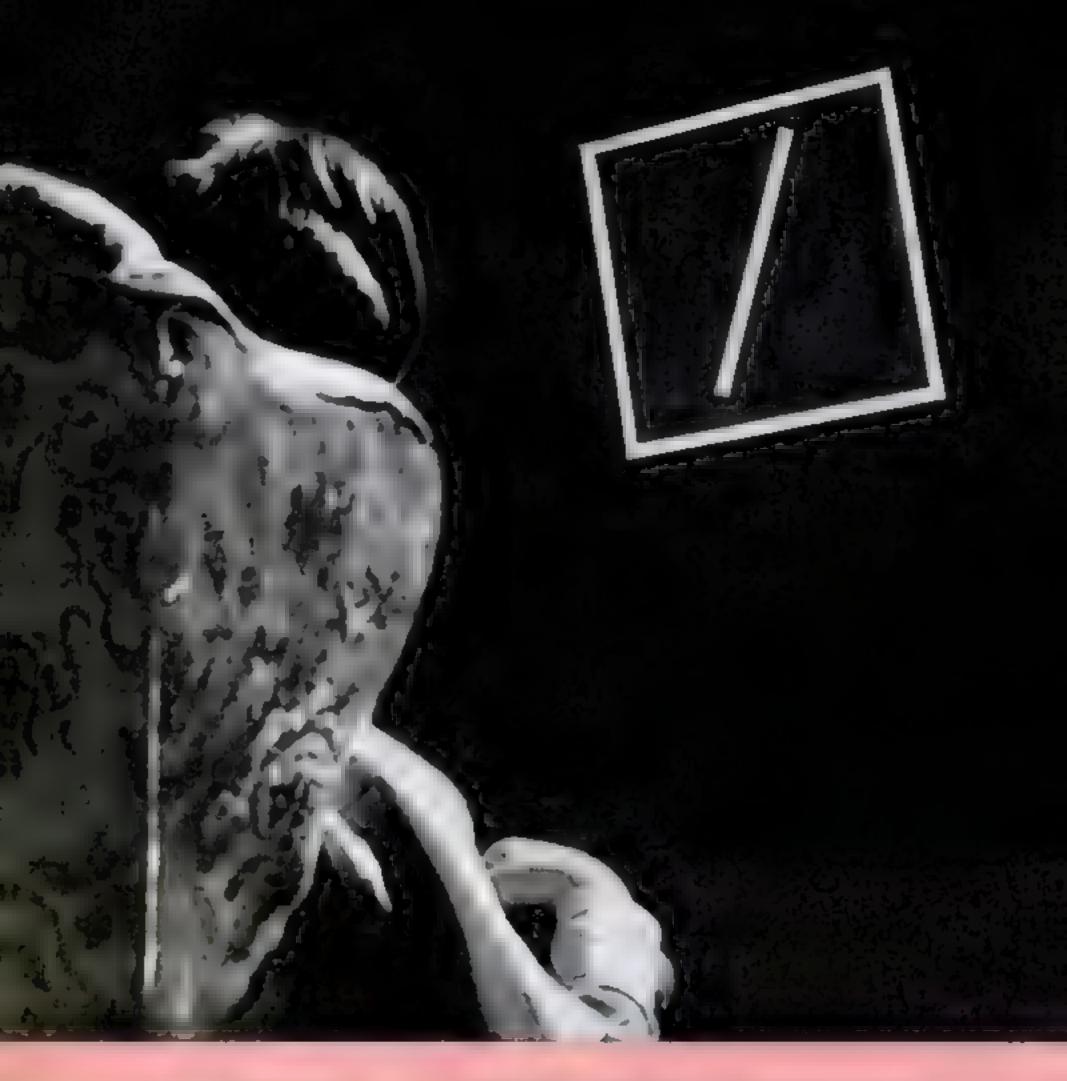
This odd-shaped steel bar can do a dozen hending jobs around an automobile. It helps turn fender beads, straighten jammed fenders, align bumper arms, and true up clutch or brake pedals. The Multi-Tool is sold by the Martin Quick-Trim Co., of Los Angeles.

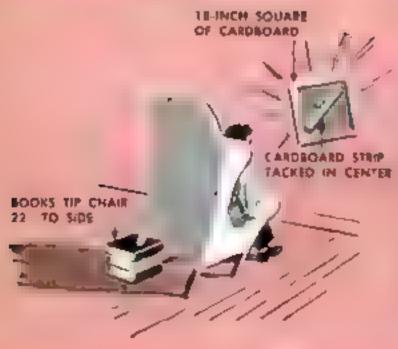


Greeting Cards Are Tree Ornaments

THESE Christmas cards do double duty. Containing suitable friendly greetings, the cards are mailed like conventional ones. But when opened up, below, they become glittering three-dimensional ornaments, ready to be hung on the Christmas tree or the fire-place mantel as an unusual decoration. Twirl-Arounds are being introduced by the P. F. Volland Co., of Joliet, Ill.







Test Your Orientation In Your Own Home

With a couple of pieces of cardboard and some bin hous paint its casy to test in your own averg room whether you know which was up. I occur by mean square of careboard and expers a half inch border with the har nous paint. Out another piece of cardboard an inch wice and approximately 15 in ches long and paint. I Pin or tack both to the wall at the eve level of a seaded person being sure that tack is through center of both francing pointer. Place a chair preferably a wang type that supports to be ad when tilted in front of frane and tip it about 22 to me side by placing books under the legs. Seat a bacet in chair with 1's eves classed extinguishing its and have been open his eves. Here we both frame and pointer bringing them to rest 15 or 20—th enter in opposite directions. Ask the subject to direct movement of the pointer so as to make it vertical

How Do You Know Which Way Is Up?

The answer—which may tell a lot about what kind of person you are—is coming out of a topsy-turvy room in Brooklyn.

By Bill Reiche

PRACTICALLY everyone, unless deliberately tricked or misled by extraordinary circumstances, knows which way is up—slang expressions to the contrary notwithstanding. In other words, almost all of us can, without any difficulty, hold a ruler in a true vertical position.

Since this is true, it might seem remarkable that the Office of Naval Research is sponsoring an intensive investigation of space orientation in man.

But at Brooklyn College, brains and ingenuity join hands under the direction of Dr. H. A. Witkin, assistant psychology professor, to discover its whys and wherefores. Devilish devices make the subjects appear tilted when they're not, make them feel straight when they're tilted; jiggle their surroundings, whirl them around, and place them in rocking cubes.

The first reason for this investigation is that among the vast variety of Navy personnel some men operate under "extraordinary circumstances" almost as a matter of routine. Flyers, for instance.

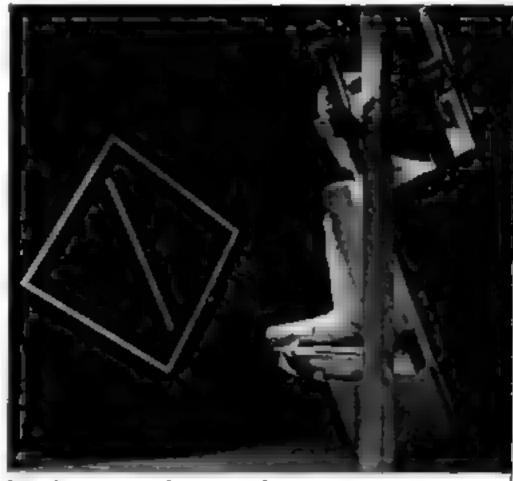
The second reason is that it may lead to a psychological technique that will enable us to know a great deal more about man and why he behaves the way he does.

Competent airmen insist that at times they can fly straight and level and not know, from their own sensations, whether they are upside down or not. Others scoff at this statement, which is psychologically suspect but not scientifically disproved.

One thing is sure: strange things happen even to experienced flyers that cannot be explained rationally with our present knowledge. For no reason now known, a seasoned pilot may experience vertigo, or loss of bearings, so that he may consider himself vertical when he is even 45° off. In extreme cases the individual literally did not know which was "up" or "down"

Take the case of Marine Corps Captain X, a senior flight instructor and combat veteran. On a training flight in night tactics he suddenly felt that his ship was peeling off in a steep left-hand dive. Despite the natural urge to use right rudder and aileron to correct the "dive," he believed his instruments, which told him he was flying straight and level. In landing, the field seemed to be tilted some 45° to the left and Captain X narrowly avoided groundlooping when he came in with left wing and left wheel down.

Captain X had enough self-discipline to force himself to believe his instruments,



The home test shown on the opposite page is performed above in Dr. Witkin's Brooklyn College laboratory. This chair pivots a set distance in either direction, has head bracket.





After a fast ride in the whirling room, above, subject is asked to straighten it and himself He usually misses badly because centrifugal force has influenced effect of gravity as a guide At left room is shown in extreme tilted position sometimes demanded by subjects.

rather than his own sensations, and survived. But in combat his confusion might well have cost him his life.

We live in a world filled with verticals: doors, windows, walls, trees, and people, to which we are so regularly exposed that they serve as constant reference points of which we are hardly conscious.

It not only looks to be an up-and-down world, but it feels the same way—for physical and physiological reasons. Gravity is the true vertical, from all points on the earth its force is directed to its center. When standing, our body is supported by a small base, and if we do not remain erect gravity will tend to cause us to fall. When seated, a variation from the vertical is noted in increased pressure on one of the buttocks or

by pressure on the arm or body from whatever is supporting us from the side.

These clues are supplemented by a pair of organs in our ears, called labyrinths. These are partially filled with fluid. When the head is moved to left or right, forward or back, the fluid moves, and we are aware of which way our head has tilted. Sort of carpenter's levels, with movement of the liquid felt rather than seen.

But a pilot, if the horizon is invisible, has no stable vertical reference; the cockpit moves with him; he must believe his instruments, often against his own sensations

If the flyer is tightly strapped in his seat, the varying pressures on his buttocks and other body areas may be difficult to translate into terms of position.

Separating the Senses

In order to discover the what and why of all this, it was necessary to devise tests that would isolate the visual factors—those that are seen—and the postural factors—those that are felt—from each other. Normally we blend them so smoothly we cannot tell which contributes more heavily to our orientation



In pitch darkness, the subject attempts to stand still on a tiltable metal plate while a luminous frame rocks dizzily in front of her.



An ataxiameter measures subject's slightest movement as she stands on solid surface with rocking frame affecting her equilibrium.

Three test setups and procedures that provide the conditions under which we can establish how people know which end is up are now in use.

You might try the tilting-room, tilting-chair test. You climb into a three-walled room, about six feet in each dimension, and sit down in a wooden chair that looks like an unsuccessful candidate for the execution chamber. Room and chair may be tilted left or right, together or separately, at the same or different speeds, by the person conducting the test. The subject cannot see out of the room, so he is dependent on his own "feel" and whatever information he can gain from the largely misleading visual evidence provided by the room

First the room is tilted 56° and the chair 22° to the same side. You are asked to bring the room back to vertical by instructing the operator in which direction and how far to move chair and room. Then room and chair are similarly tilted, but to opposite sides, and you again must try to get the room back on an even keel.

Up to now you've only had to straighten up the room. In the next test the cubicle and the chair are tipped 35° and 22° respectively, in the same direction, and you're asked to straighten yourself up.

In the final trial-by-tilt, the room and chair are tilted as before, but in opposite directions. Again you are asked to bring yourself to the vertical.

How would you have made out? It's difficult to say without an actual test. One man managed to bring the room to an average of 2.5° of variation from the vertical in four trials; a woman, on the other hand, considered it upright at the original 56° tilt.

The average error for men in bringing the room to the upright was 22.9° and for women 28.1°. When the men considered their bodies vertical they were off an average of 8.2°; women missed by 10.3°.

Seeing Is Not Believing

The greater error in straightening the room than the body is hardly surprising. More people stand straight than can hang pictures evenly. This test measures the individual's perception of his own body and the surrounding field in relation to the vertical.

Note how much these results tell about the individuals. The man who could bring the room to the near-vertical depended almost entirely on what he felt posturally, since everything he could see was misleading. The woman who called the room vertical when it was 56° off was dominated by the visual factors—she depended so strongly on her surroundings, what she saw, that she ignored the postural factor entirely and made the greatest error possible.

Now you are taken into a darkened room to check your perception of a single item in a field. A luminous square frame, about the size of a bridge-table top, surrounds a luminous rod. Both are pivoted. All the subject can see is the frame and the rod.

The subject and frame are tilted 28° in the same direction and the rod is to be returned to vertical from a position 28° off vertical. Next the subject and frame are tilted in opposite directions, and finally the body is erect and the frame tilted.

The influence of the visual factor again appears to be demonstrated when subjects tried to straighten things out. With body and frame tilted in the same direction the average error for men was 12.5°, for women 16.7°. Tilted in opposite directions, the sexes went astray 14.5° and 18.3°, respectively.

When the body was erect, and could serve as a guide in bringing the rod to the vertical, the average error was 7.4° for the men and 12.1° for the women. The tendency to believe that a field must be vertical—or

nearly so—since it is in every day experience, is a difficult one to overcome, regardless of contradicting collateral evidence.

So far, while the body has been tilted, gravitational force has been constant and helpful if the subject could interpret it. But gravity has a horizontal cousin, called centrifugal force, that can influence his kinsman when they go around together. This is done in the rotating-room test, a fine bit of psychological trickery that involves a tilting chair, a tilting field, and an ability to put gravity locally out of whack.

"Lookers" vs. "Feelers"

The room is fully enclosed and mounted on a carriage that is driven around a circular track. The subject is whirled about with both room and chair vertical and asked, via telephone, to straighten the room. In a subsequent run, under the same circumstances, he is asked this time to bring the chair to the vertical.

At the rate the room was moving, centrifugal force altered gravity to the extent that the force on the body was 39.9° off the true upright. Gravitational force, instead of being straight down, had moved almost half way to the horizontal. The extreme visual type would demand no adjustment of room



In the auditory-visual conflict test the subject, background, sees the tester's face directly be-

fore him in mirror, but his voice "moves." Subject is asked when it "moves," and which way.

or chair, since they were upright and looked it. In extreme cases of the postural type, they had the chair moved to a position at right angles with the force, cancelling it out entirely, and making the subject believe himself upright from the standpoint of feel.

In related tests, the same general tendencies are revealed. In one test, the subject stands on a tilting metal plate in pitch darkness. The outline of a luminous cube rocks back and forth about him. Instruments measure how much he loses his balance and the intervals when he must hold a support. Then, while standing on a solid floor an ataxiameter (an instrument for measuring involuntary unsteadiness of bodily position) measures the body's sway as a cube rocks before the weaving subject. In an auditoryvisual conflict test the subject sees the tester's face directly before him, but his voice "moves" to right or left by means of controls The subject must tell when he notices the voice "move." and its direction.

Immediate goal of the ONR studies, still far from completion, is to reveal what happened to Captain X, and to guard Lieutenant Y and Major Z in the future. But they will also lead to greater knowledge about how the individual perceives the world and himself.

The psychological conclusions are far from complete, but general information has come to the surface that promises the development of valuable techniques.

Strong reliance on the postural factor may be a danger signal indicating one of several psychological leanings. The hurt child becomes self-centered, full of suspicion and distrust, and in his indifference to the world relies on how he feels. This type may develop into a man who is extremely self-centered and self-satisfied. He will show his disregard for the world and satisfaction with his own capabilities by almost ignoring what he sees in favor of what he feels. The same applies to the person whose difficulty in dealing with the world causes him to withdraw into himself.

Extremes Cause Trouble

Sensitivity to the visual factor is seen in the insecure individual, who is hypersensitive to the standards of the world.

The extreme type, either way, is in trouble.

The results of these tests are not final answers, but components in the great mosaic of psychological testing, that may help us one day to understand the most important device in the world—man.



With subject tilted 22° left and room 56° right, he is asked to bring the room back to the ver-

tical. If he is fairly successful, it indicates he judges mainly by feel, since sight is no help.



Low lines, pronounced windshield slant give Road-Jet fast, sporty look. Car is 41/2 ft. high.



Roomy trunk, 47 inches wide and 44 inches deep, has carpet on floor. Wrap-around bumpers at both front and rear, set into body panels, are integral with frame for strength

Powerful engine is stock 160-hp., 8-cylinder Cadillac, with Hydra-Matic drive that chiminates clutch pedal. Special engine suspension is designed to give good roadability on fast turns.

\$5,000 Sportster: Long, Low, Full of Gimmicks

THE Kurtis sports car, once sold as a build-it-vourself kit (PS, May '50, p. 136), has gone de luxe. Now called the Muntz Road-Jet, the low-slung, sporty coupe will soon be offered as a semi-custom job by West Coast promoter Earl "Madman" Muntz. who expects its 160-hp. Cadillac engine to help it sell

Standing only 54 inches high, the 178 inch, spruced-up speedster is 13 inches longer than its predecessor, but retains the same sleek, low lines. Gadgets galore include

THE Kurtis sports car, once sold as a a crash-padded dash, safety belts, and built-build-it-vourself kit (PS, May '50, p. in ice boxes. The car will hit 125 m.p.h.

A welded-steel frame covered with aluminum body panels is said to provide high strength at low weight. The car uses coil springs in front and leaf springs in the rear. Both exterior and interior will be finished in colors of the customer's choice.

Priced at \$4,995, from the Kurtis-Kraft plant at Glendale, Cahf., the five-passenger "Convertacoupe" has an all-metal, Frenchtype top, removable for open driving.



Armrest dividing front seat also serves as ash tray and glove compartment. Two similar armrests on both indes of rear seat contain ice boxes to keep beverages cold. Note safety belt.



Aircraft-type instruments are grouped directly in front of driver, include tachometer, oil-temperature, and vacuum gauges. Right side of dashboard is padded for crash protection.

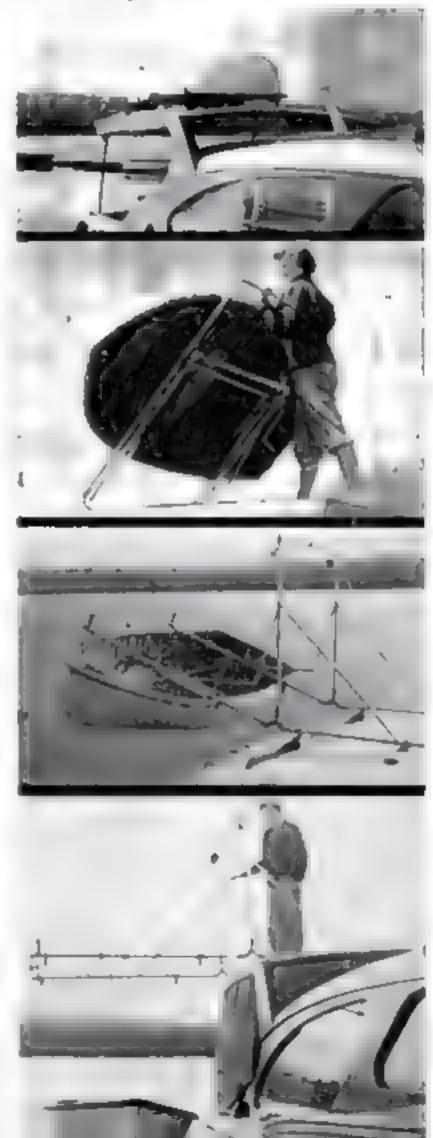


Head-on view emphasizes car's low, racy look. "Convertacoupe" model shown has plastic top, but production version will have metal French type. Car weighs 3,300 lb., has 113-in. wheelbase.

DECEMBER 1950 115

Hoist Launches Dinghy Fast

ONE person can move a dinghy in 60 seconds from its stowage place to water with this aluminum hoist. First the rig is pushed up to a vertical position. Then a crank is turned and the arm that holds the boat drops out over the water. The dinghy is lowered on cables attached to both ends. Steps in the launching are shown below, from top to bottom. To raise the dinghy, the procedure is reversed. Called Doist, the launcher is made by the Diamond W Mig. Co., Schenectady, N. Y.





To convert this Zenith to color, CBS engineers added adapter in back, filter disk in front.

It means new entertainment—and new problems—for everyone who owns a set or is thinking of buying one.

By Martin Mann

AFTER 10 years of spiteful, even victors squabbling, color television is here. Columbia Broadcasting System is set to start TV shows this month in realistic, full color using its own "field-sequential" method. It is this method that has won the official blessing of the Federal Communications Commission as the U.S. color TV system.

Your receiver, like the rest of the 10.000,-000 already built, can't receive these shows. It will get either a blur or several small pictures side by side when tuned to color TV.

But you needn't stay out of the color put ture long

Manufacturers of some sets will have color attachments for their own sets on the mar-

Despite the FCC's "final" decision in favor of CBS color, many TV manufacturers are continuing their fight against it. They have started legal action that may delay the timetable set for color. It'll probably take a ruling from the US. Supreme Court to put a stop to the wrangling once and for all

ket in a few weeks. Several firms have also promised to offer adapters and converters for other makes of sets soon.

An adapter hooked to your set clears up the screen so that you can see the coloreasts in black-and-white, but not in color. Probable cost: at least \$35.

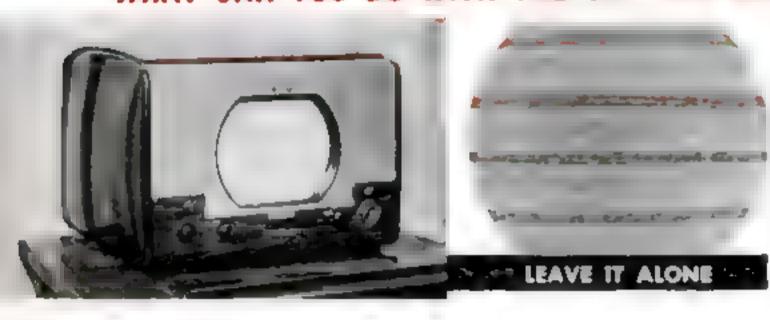
A converter, which includes an adapter plus a spinning color disk, brings you the whole thing—full-color pictures. Probable cost: at least \$110. You may be able to convert your set yourself at less cost, but that depends a great deal on the set (see p. 120).

It'll probably be summer at the earliest before new sets, with color built in at the factory, reach the market. Prices should start around \$300 for a combination color and black-and-white set with a 10-inch viewing tube magnified by a lens.

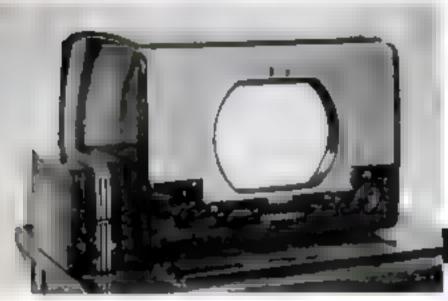
So far, only two stations in the country— New York's WCBS-TV and Philadelphia's WCAU-TV—are definitely committed to transmit color. And they will start with no more than 20 hours a week, mostly at offhours times.

These shows will be available to any of the other 61 Columbia network stations that want them and are connected to New York by coaxial cable or microwave relay. Anybody else who wants to telecast color can

WHAT CAN YOU DO WITH THE SET YOU HAVE NOW?

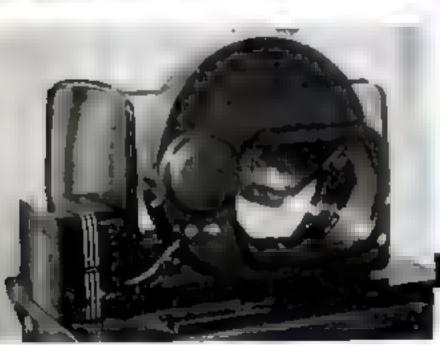


This blur is what most existing TV sets will get when tuned to a CBS coloreast. Some others may show several small pictures side by side. The reason today's sets can't get color shows is that technical standards were changed for color. Of course, old sets still receive black and white.





An adapter—the black hox at the far left in the photo—brings in a clear, single picture from colorcasts. But in black and white, not color The adapter is actually an extra electronic circuit that changes the works of your set to make them conform to the new color standards.





motor-driven color disk to the adapter does the trick (these two units together are called a converter). The disk puts red, blue, and green filters in front of the tube in exact step with similar filters in the TV camera, creating the illusion of full color.

Here's color, Adding a



When sets with the color built into them become available probably in six months or suthey may look like these experimental models designed by CBS engineers. The color disk is completely enclosed, folding aside when the receiver is switched to black-and-white telecasts.



buy color cameras and originate his own. How quickly colorcasting will spread—to more popular hours and to more stations—depends on how quickly the public buys sets that can receive color. The same show can not be broadcast in color and in black-and-white at the same time. It's certain to be several years before the big majority of the top programs are broadcast in color.

So there's no reason to junk your present set. But if you don't own a TV receiver now and are thinking of buying one, the dcision becomes more difficult. You can go ahead and buy the black-and-white set and be sure of several years of fine entertainment. You can probably add an adapter or a converter when you want to. On the other hand, you can wait—meanwhile missing a few months' shows—for a set with built-in color or one with a built-in adapter.

The reason for all this confusion over adapters, converters, built-in color, and black-and-white sets lies in the system of color television the Federal Communications Commission selected. This system is simple, comparatively inexpensive, and gives good color, but it does upset the applecart of present-day TV-it cannot be received by

existing black-and-white sets.

To understand why, look closely at a black-and-white TV picture. You will see that it is not a smooth blending of light and dark tones, like a photograph, but is actually composed of 525 individual lines of varying shades of gray. The camera creates these lines by running its electron beam across the scene from left to right, then turning the beam off while it is moved back to the left and down to the next line, then on again while it "scans" this line. During one trip from top to bottom, half the lines (one "field") are scanned. Then the beam goes back to sean the in-between lines it had skipped. Two fields, making one 525-line "frame," are sent out 30 times a second. The same thing occurs in a receiver, the frames following each other so fast they merge.

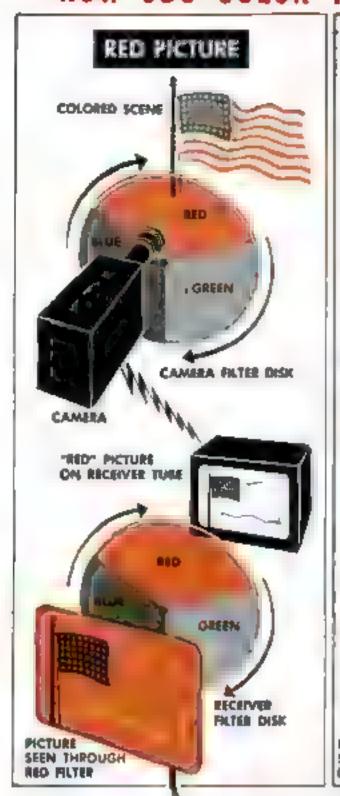
CBS Color Needs More Fields

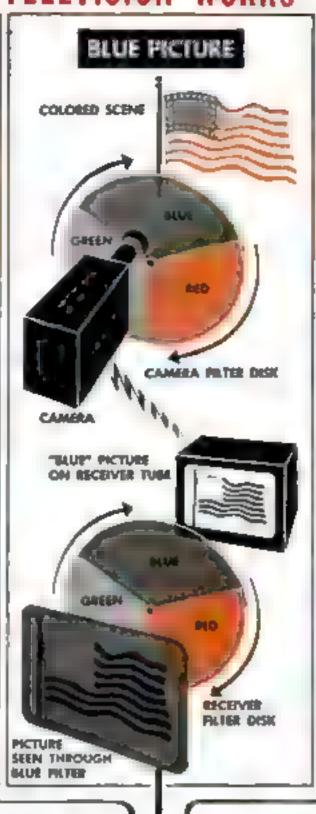
The CBS color technique works much this way. But the first field is made with a red filter behind the camera lens, the second field with a blue filter, the third with a green filter, and so on. In all six fields—two each of red, blue, and green—are needed to make one full-color frame. Again the same thing occurs in a receiver. The fields—cach viewed through the correct filter—follow each other so fast they merge into moving, full-color.

Unfortunately, you can't just start transmitting three times as many fields as you did before. (You can't, that is, without taking up more space in the crowded airwaves, and this isn't feasible.) If you increase one part of the load by tripling the number of fields, as CBS color does, you must decrease some other part to compensate. CBS compensates by reducing the number of lines and frames. The lines are cut from 525 to 405, and the frames are cut from 30 per second to 24. (Though this coarsens the picture, the color more than makes up for it.)

These changes cause the trouble. Existing

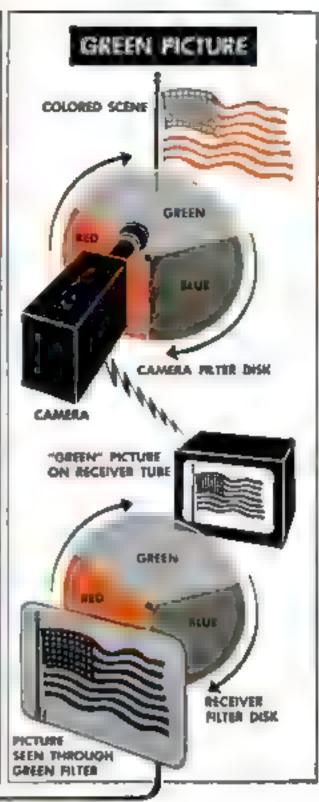
HOW CBS COLOR TELEVISION WORKS





SEPARATE PICTUPES

INTO PAULCOLOR SCENE



Color TV actually transmits a series of black-and-white pictures, each made through a colored filter. These appear on the viewing tube in black and white, gaining their color only because you look at them through a filter like the one on the camera. The drawing above (which shows equipment simpler tys mences than that actually used) explains how a U. S. flag is televised. Light

from red stripes can pass only the red filter, so a signal for red stripes is transmitted only when the red filter is in position. This signal creates a white area on the receiver tube, which is colored red by the receiver filter. The blue is sent in a similar way. Light from the white stripes and stars passes all filters, so you see a quick succession of red, blue, and green, which blend to make white.

receivers are designed for 525-line, 30-frame TV. Their deflection circuits move the elec- white receiver to color standards. In many tron beam back to the left 15.750 times $(525 \times 30 = 15,750)$ a second and to the top 60 times (for 30 two-field frames) a second. For color, the electron beam must scan 405 lines in three colors 24 times every second, moving to the left 29,160 times $(405 \times 3 \times 10^{-5})$ 24=29,160) a second and to the top 144times (for 24 six-field frames) a second.

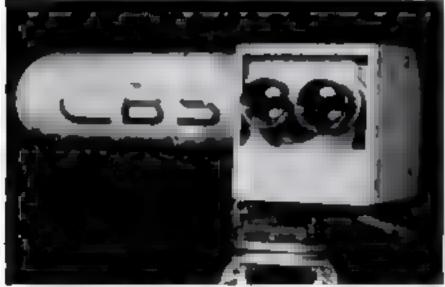
Changing the deflection circuits so that the electron beam moves at these new rates

is what is involved in adapting a black-andsets, this is extremely simple, requiring no more than the replacement of a resistor or two. But in others, particularly more elaborate ones with "locked" deflection circuits that keep the picture very steady, extensive changes may be needed. Adapted black-andwhite sets also need a switch—automatic ones have been invented--to cut the new circuits out for old-style black-and-white.

Receivers adapted in this way will show



Several different types of lightweight color cameras have been developed. The one above, shown being focused on model Patty Painter, has also televised surgical demonstrations.



Another style of color camera used by CBS for its experimental telecasts is shown above. Most cameras do not use filter disks, but have vari-colored drums rotating behind their lenses.

colorcasts, but only as black-and-white pictures. To add the color itself, you need a rotating filter disk in front of the screen

This complicates things still more. The receiver disk must rotate exactly as fast as the camera disk or the colors will wash out. It must also be "in phase"—red in front of the viewing screen when red is behind the camera lens—or actors may have green faces and blue lips. Simple circuits, synchronizing receiver and camera disks the way receiver and camera tubes are now synchronized, can accomplish this dependably.

The disk also limits the size of the directview picture to about 12% inches. The disk obviously has to be twice the diameter of the viewing tube, and few people would want disks bigger than two feet across in their living rooms.

Since the change-over to this color system

raises so many problems, why did the Federal Communications Commission pick it? The answer is simple. The Commissioners felt it was the only good one!

Four different systems were suggested, but the real contest arose between Columbia's and RCA's. The RCA method had the big advantage of being "compatible"—it required no change in deflection rates and could be received on existing sets (in black and white) just as they are. This would eliminate the big change-over problems: TV fans wouldn't miss any shows even if they didn't want to alter their sets, and telecasters wouldn't lose any audience by shifting to color.

But overriding the compatibility advantage, the FCC found many serious faults with the RCA system. To quote a few from the Commission's 59-page official report, "the color fidelity is not satisfactory... the picture was marred by misregistration (colors failed to superimpose properly)... at none of the demonstrations was a practical home receiver shown... no practical converter (for putting color—not just black and white—on existing sets)."

Report Praises CBS Color

The FCC's reaction to CBS color was just the opposite. Again quoting from the official report, "... a color picture that is most satisfactory ... receivers are simple and should be within the economic reach of the great mass of purchasing public ..."

But why did the FCC have to approve any system now? Why couldn't the color decision wait until RCA's compatible system was improved? The Commission said a good compatible system might never be developed. And delaying the decision while more and more black-and-white sets were built would only make it harder—or even impossible—to adopt a noncompatible system like Columbia's.

Although the FCC has settled for a long time to come the standards for color television, improvements in the system are already on the way. Many laboratories are working on the three-color tube (PS, June '50, p. 108), which can be used with the Columbia technique. This tube would eliminate one of the main objections to CBS color—the cumbersome filter disk that hmits the screen size.

Meanwhile beautiful color is here. For a reasonable investment of money and effort you can start enjoying it right now.

Your 7-Incher Can Catch Color Telecasts

Adding two resistors will adapt a little set to the new standards, but you will need a wheel to enjoy the colors.

By Norman L. Chalfin

THE easiest sets to turn into color television receivers are the little 7-inchers.

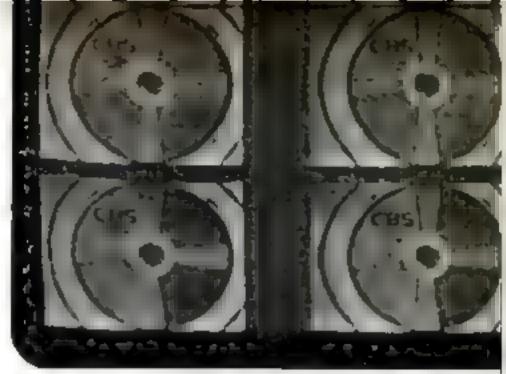
 Adding two resistors will adapt these small sets to the CBS standards and enable you to see black-and-white versions of the color broadcasts.

 Adding two hold controls and a switch will then enable you to receive both standard black-and-white telecasts and blackand-white images of the CBS colorcasts on the same set.

 Placing a color wheel in front of the 7inch screen of a set modified in these ways will enable you to see the broadcast in color.

Adapting a larger set to the color standards may entail much more work and possibly replacement of some major parts. The color wheel needed to obtain larger color pictures is also more cumbersome.

Many 7-inch sets have been shunted



Four tiny images like these will bob up on the screen of nearly every 7-inch TV set when it is tuned to a channel carrying CBS colors. Bigger conventional sets may just get a blur.

aside or traded in by purchasers of the more popular big-screen sets and are now available at much lower prices than the big sets. So this makes them the logical choice for anyone who would like to try his hand at turning a black-and-white receiver into a color set.

The Deflection Circuits

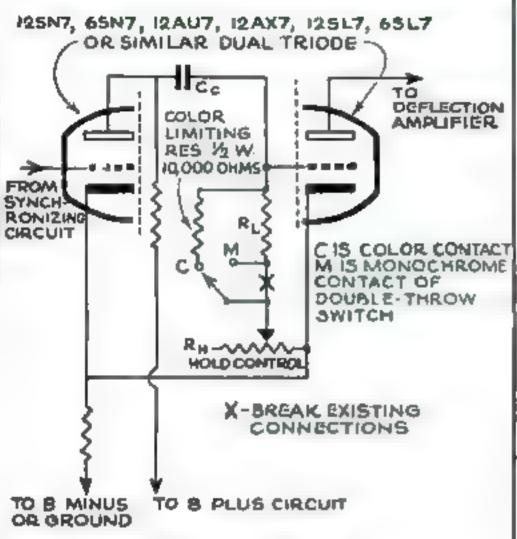
Every TV receiver contains two deflection oscillators—the circuits that move the electron beam horizontally and vertically. In all 7-inch sets, they are either multivibrators or blocking oscillators—although they often are referred to by other names, such as "sweep generators," "sweep oscillators," and "saw-tooth generators." Putting a new resistor that has a lower value into each oscillator will change the sweep frequencies to correspond with the color standards.

Identifying the deflection oscillators in

The author sees color pictures by placing this \$20 wheel in front of his adapted 7-inch TV set,



DEFLECTION CIRCUITS LIKE THESE ARE USED IN 7-INCH SETS



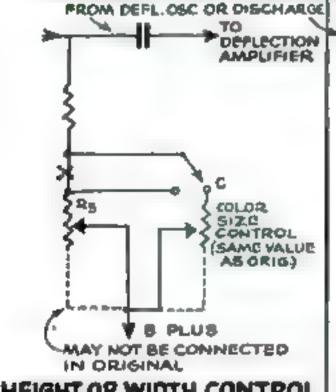
MULTIVIBRATOR (HORIZONTAL OR VERTICAL) FROM SYNICH- TO DEFL AMR- TO DEFL AMR- CIRCUIT OSC SECTION SECTION

BLOCKING OSCILLATOR

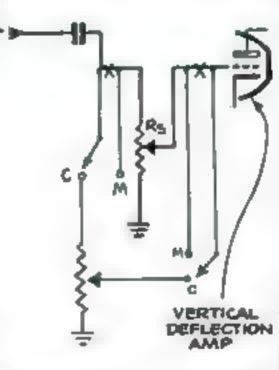
Colored lines show where resistors can be added, and switch cut in so set can be used to receive either monochrome or color telecasts. Every set has two deflection circuits, Both must

be changed. One may be multivibrator and the other a blocking oscillator, or both may be the same. These are typical circuits; yours may differ in some respects. Consult your set diagram.

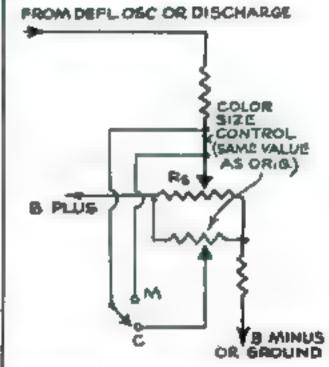
SIZE-CONTROL CIRCUITS LIKE THESE ARE USED IN 7-INCH SETS



HEIGHT OR WIDTH CONTROL (B PLUS TO OSC PLATE)

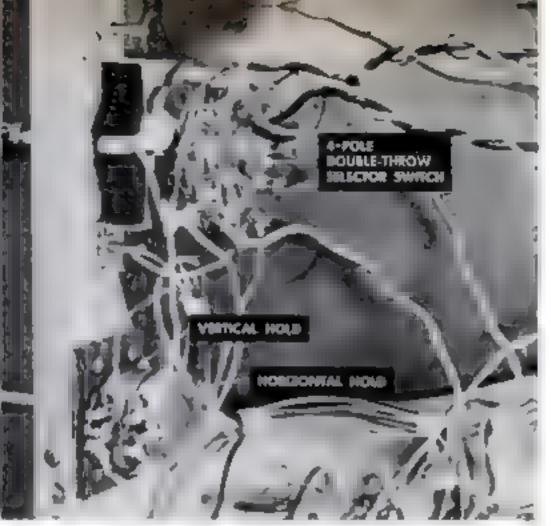


HEIGHT CONTROL IN GRID OF VERT, DEFL AMP.



HEIGHT OR WIDTH CONTROL

New controls must be added to avoid readjusting picture size whenever you switch from monochrome to color. Your height control may be any one of these three types; width control may be either of two so marked. Minor variations not indicated in drawings can be disregarded. If your set has height control shown in center you will need an extra switch pole.



Color switch put on front of Tele-Tone 149 by author is 4-pole, 2-position flat wafer. Its shaft goes through cabinet to a small knob centered directly beneath the 7-inch screen.



Size controls for color pictures are mounted on plastic strip, attached to rear apron with spacers, directly below monochrome controls. Once set right, they seldom need be changed.

some sets, however, is difficult. The best way to locate them is to consult a schematic wiring diagram—but be sure it is the right one. There are variations even among sets bearing the same model number. So, if you ask the manufacturer for a diagram, you should give him the serial number as well as the model number of the set for which you want it.

In most cases the central part of the oscillator circuit will be a dual-triode tube. Trace the connections, however, before you make any changes. It is dangerous to work on a TV set without being sure what you are doing.

Look For These Circuits

A basic multivibrator circuit is shown alongside a blocking oscillator circuit on page 122. In the multivibrator, both halves of a dual triode are used. Energy is exchanged between them through interconnected cathodes. The frequency of this oscillation depends on the capacity of the coupling condenser (C_C) and the combined resistance of the limiting resistor (R_L) and the variable resistor hold control (R_H).

A blocking oscillator requires a transformer. Opposite windings of this transformer are connected to the grid and plate of a triode. In most sets this is a dual triode, one half of which serves as the discharge section. The two grids then are

tied together. The hold and limiting resistors are usually in the grid circuit, and the rate of oscillation depends on the values of the coupling condenser (C_C), the grid resistance (R_L plus R_H), and the impedance of the transformer.

Switch Is Helpful

To change the frequency of oscillation in either a multivibrator or blocking oscillator circuit, you have only to change the value of one of the parts that determine it. (You do this, incidentally, every time you adjust your set's vertical or horizontal hold control.)

The simplest way of doing this to adapt a 7-incher to colorcasts is to reduce the resistance of the limiting resistor (R_L). This can be done by substituting a 10,000 ohm, X-watt resistor for it. If you place a double-throw switch between the limiting resistor and the hold control, you can then throw this switch one way (M) and get monochrome pictures as usual and throw it the other way (C) and get color pictures—assuming you use a color wheel.

The picture-size controls will have to be readjusted whenever you switch from monochrome to color programs, however, unless you also put in a new set of size controls. The colored lines on the diagrams at the bottom of page 122 show how these can be put in. They should have the same resis-

tance as the size controls already in the set.

You may have to experiment a bit to find the control settings at which both color and monochrome images fill the picture frame properly. But once you've found them, no further adjustment of the size controls should be needed. I placed mine on the back of the set, and connected them to the color switch on the front, so that simply turning this switch gives me either monochrome or color images.

Color Requirements

The most difficult part of the job is likely to be identifying the parts accurately. After that, make sure that you connect all pairs of switch contacts so they operate in the same direction. Then one switch position will bring all color poles into the circuit and the other will close all monochrome contacts.

Once you have adapted your set in this way, you will probably want a color wheel. It should have six equal wedges of transparent colored material. Two wedges should be red, two blue, and two green. If you can synchronize such a disk so that each wedge is in front of the tube for 1/144 of a second, your eye will mix the three colors into every hue of the rambow.

The simplest one I've seen is the \$20 Celomat "Vue-Scope" shown in the photo on the first page of this article. It is simply a three-color wheel, a motor, and a speed regulator, which you can set in front of you and look through. You have to adjust the speed-control frequently, however, because it does not contain any device to keep it synchronized with the pictures.

More such "converters" will probably be available soon.

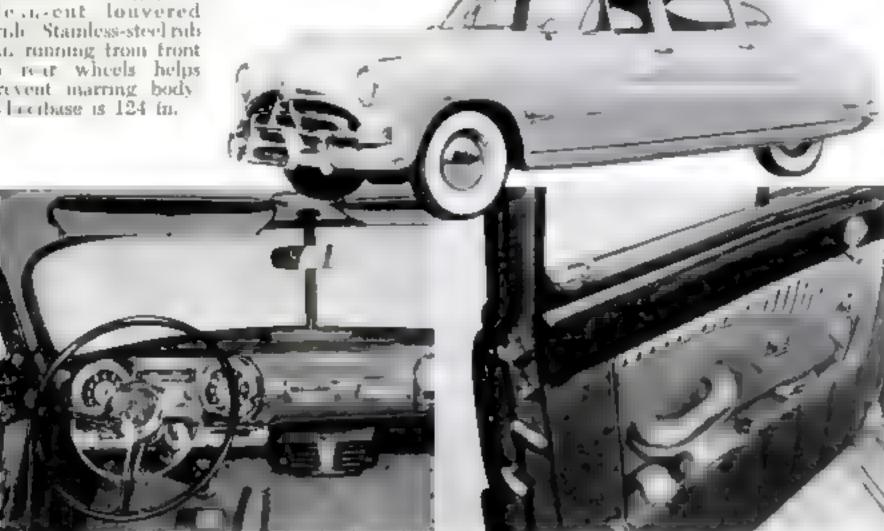
Hudson Adds New Hornet Series, More Powerful Engine

LATEST addition to the Hudson line is this fast, new Hornet series, powered by a 145-hp., high-compression (7.2 to 1) engine. This is said to be the most powerful sixcylinder auto engine now in production.

Standing only five feet high, the new Hornet continues the recessed, "step-down" floor, providing greater headroom at a lower roof line and center of gravity.

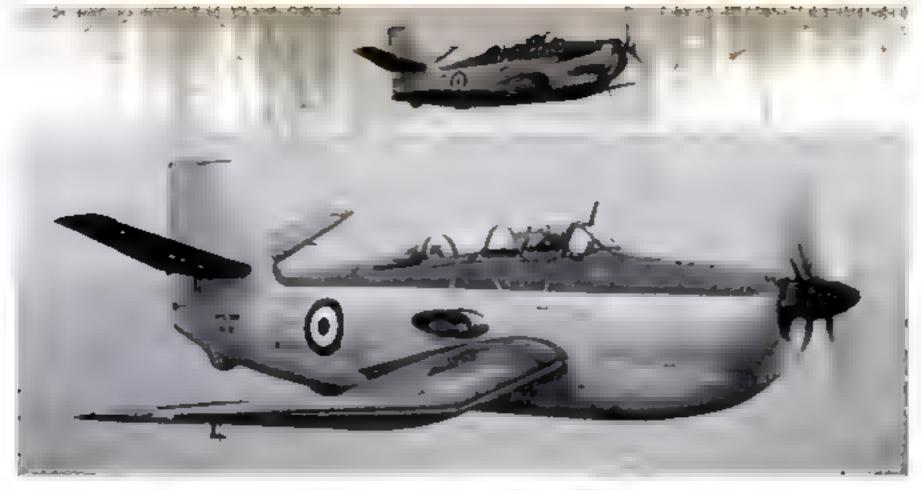
Also new in Hudson's 1951 line is the provision for Hydra-Matic Drive as optional equipment in the Homet and Commodore Custom series. The Super Custom and Pacemaker Custom also offer Super-Matic Drive.

New Hudson Hornet stands 5 feet high, has clearent louvered gride Stainless-steel rob r.a. running from front to rear wheels helps prevent marring body Wheethase is 124 fm.



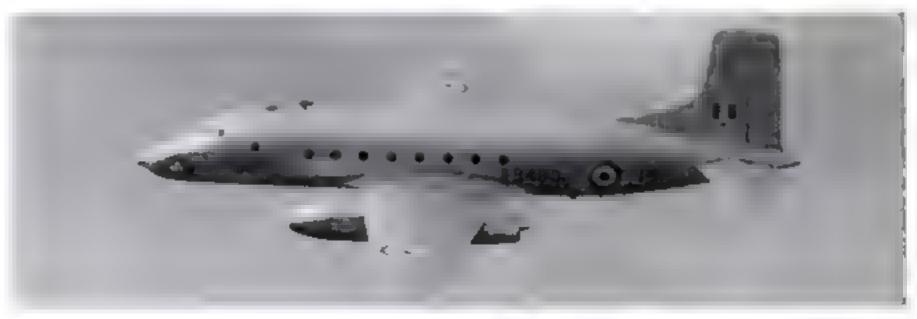
Instruments are grouped directly in front of driver, easily visible through spokeless top half of steering wheel. Right-hand side of dash is cut high to provide plenty of knee room.

Window controls, door pull, and ash trays are recessed into door panels, increasing elbow room by 2 in, and eliminating projections. Front and rear seats are both 64 in, wide.



Britain Shows New Planes: Twins Offer Choice of Engines

THESE anti-sub planes, developed for the Royal Navy by Blackburn and General Aircraft, are identical twins—except for their engines. The nearer one, designated Y.B. 1, is powered by a double turboprop unit; the other, Y.A. 5, by a piston engine.



Big Jet Lab Files High and Fast

THE big British Avro Ashton above—90 feet long and with a 120-foot wingspan—is a pressurized laboratory for studying the

problems of high-speed and high-altitude jet transport and bomber design. One of six recently ordered by the Ministry of Supply, the plane has a speed of 400 m.p.h., provided by four Rolls-Royce Nene Turbojets.

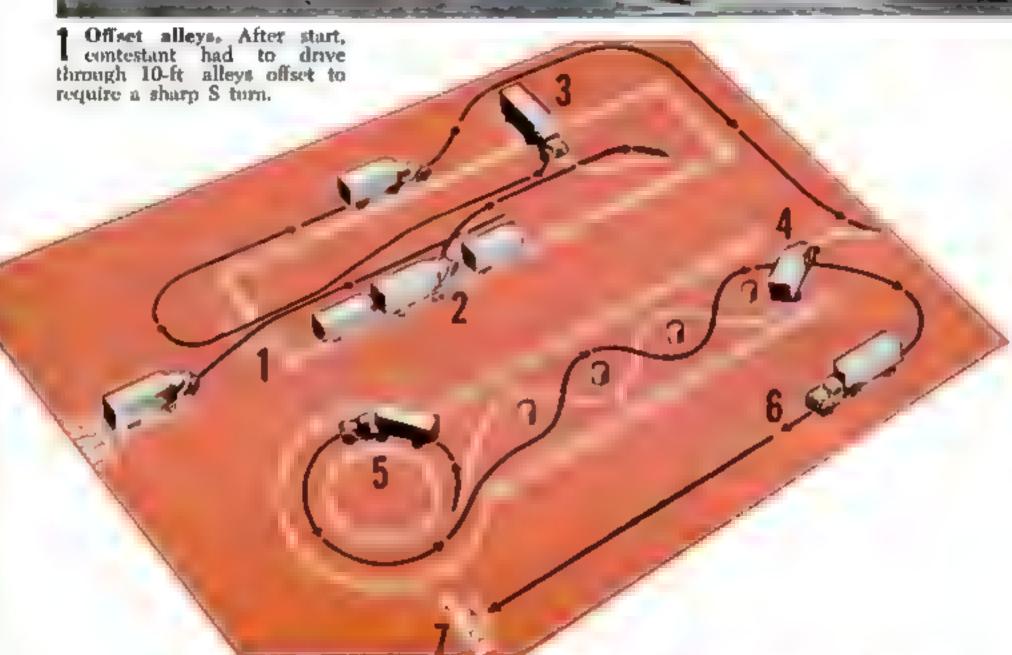


Flying Triangle Tries Its Wings

BRITAIN, like the U.S., is experimenting with jet-powered, delta-wing flight. This Avro 707B carries automatic observers,

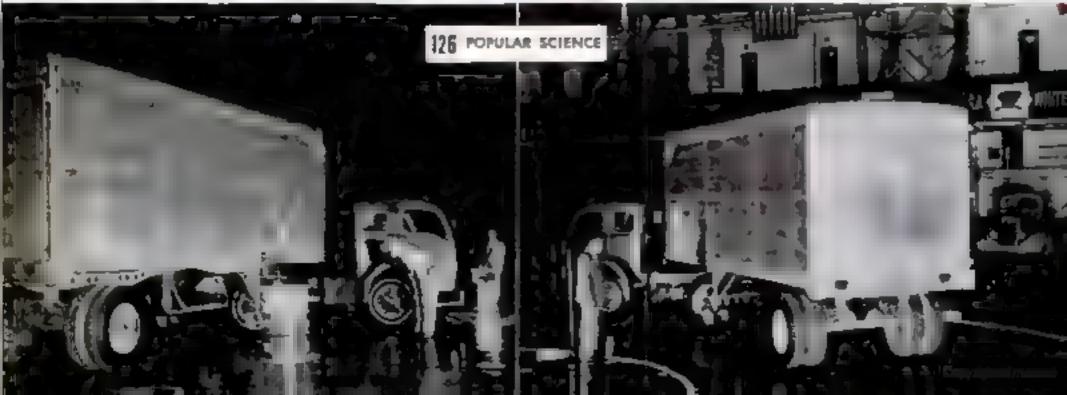
movie cameras, and other research equipment. Opening in top center of fuselage is air intake for the Derwent engine. Cylinder at base of the tail contains an anti-spin parachute that also can be used to slow landing.





4 Serpentine consisted of four barrels. The contestant had to snake his big semi-trailer first backward and then forward between the barrels without jockeying or stopping.

5 Circle tested driver's ability to wind his tractor-trailer around a sharp turn like those found in most "go-arounds." Markers were placed to allow little room to spare.







2 Parallel parking. To succeed here driver bad to park his trailer between two other tracks a space only 4 it longer than the trailer Straight tracks got 6 ft, to spare. When parked,

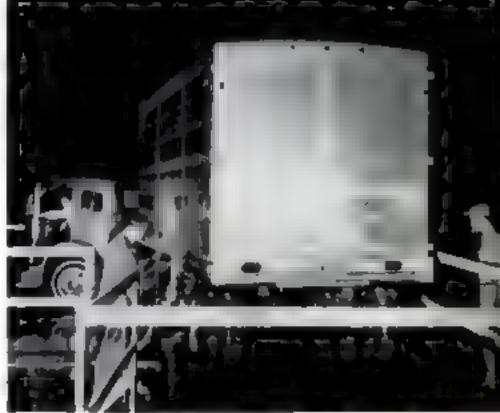
the vehicle had to be within 6 in of the corb or the driver lost points for every men over He also lost points if he had to pickey his vehicle more than once.

Precision Driving Wins Truck Roadeo

PS PHOTOS BY W. W. MORRIS

FOR three days recently, 92 truck drivers from 30 states maneuvered big trucks around a tricky obstacle course in a New York City armory. They were contestants in the annual National Truck "Roadeo." sponsored by the American Trucking Associations, vying for honors as the nation's top drivers in four classifications—straight truck, single axle semi-trailer, taudem axle semi-trailer, and truck and full trailer. Map at left, and photos numbered to pair up with it, show what they had to do to win— i sp

6 Straight-line test consisted of double row of balls poised on tees so sightest touch knocked them off Contestant had to run right wheels through without touching them.



3 Alley dock represented narrow alley with a loading platform at the end Driver had to case trader into the 10-ft wine alley without tenching and step within 6 in of end

7 At finish, driver had to stop his velicle within 6 in of stop line. Fo quality, he also had to complete the course in less than 10 minutes. Time affected final score.





Motor Scooter Tows Sea Scooter

Towen to the water's edge behind a motor scooter, this miniature Italian motorboat (left) can be hand-launched by its two passengers. They just lift it off the trailer and into the drink. The tiny craft, weighing only 220 lb., has a top speed afloat of 8 m.p.h. and carries enough fuel for a 5-hour cruise. It sells in Rome for about \$480—without the towing scooter and trailer.

'Dozer-Digger Fits Tractor for Contruction Jobs



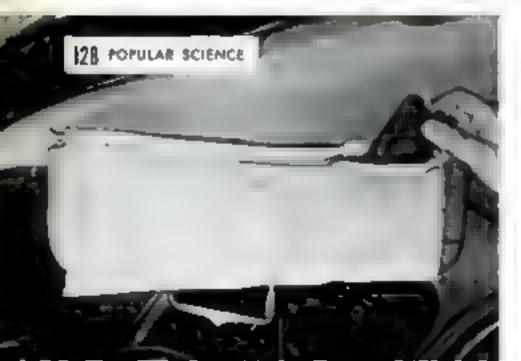
A STANDARD tractor turns into a construction machine when a buildozer is added to one end and a scoop shovel to the other. The shovel can dig a ditch seven feet deep and 50 feet long in one hour. The 'dozer, which can be installed in 20 minutes, is controlled by one valve. Both implements, made by Shawnee Mfg. Co., Topeka, Kan., will fit Ford and Ferguson tractors.

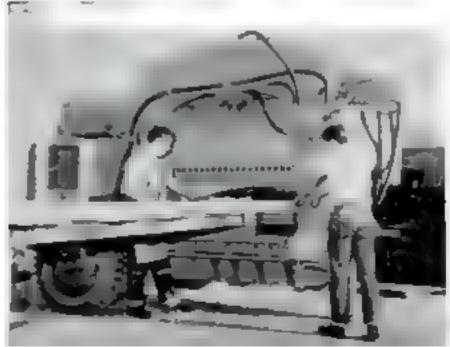
Driver's Carryall Sildes on Sun Visor

HERE's relief for that overcrowded glove compartment. It's a new plastic pouch, tailored to slip over any car's sun visor as shown below, that keeps your glasses, cigarettes, and other odd-and-ends within easy reach while driving. When the visor is up, the sleeve also makes a map holder, with a pencilled route clearly visible through the transparent plastic. The pouch, about 6 inches deep and 15 inches long, closes with a zipper fastener. Edward Steele, of Pittsburgh, sells it for \$1.49.

Sharp Teeth Split Rock With Ease

Two rows of sharp teeth in the machine below put a 200,000-lb. bite on the toughest quarry rock, splitting it apart smoothly. A hydraulic equalizer brings the two jaws, each with 19 tool-steel teeth, 2% inches wide, against the rough surfaces with equal force. Called the Guillotine, the machine weighs 5% tons, and can handle 100 tons of rock a day—sandstone, limestone, granite, or marble. Made by the Vesper Co., of Glendale, Calif., the machine is operated by a small gas engine or an electric motor.





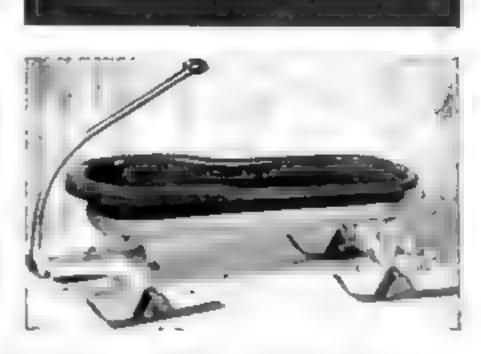


Thrill Ride Defies Gravity

THE floating eard players above aren't magicians—their chairs and table are held in mid-air by the centuringal force of a whirling drum. The giant drum (right), a new amusement-park thrill ride at Frankfurt, Germany, revolves at 15 m.p.h. At top speed, its floor suddenly drops down, leaving the riders pinned to the walls by a force double their own weight. Above the drum are six balconies from which spectators can look on.

Runners Convert Wagon to Sied

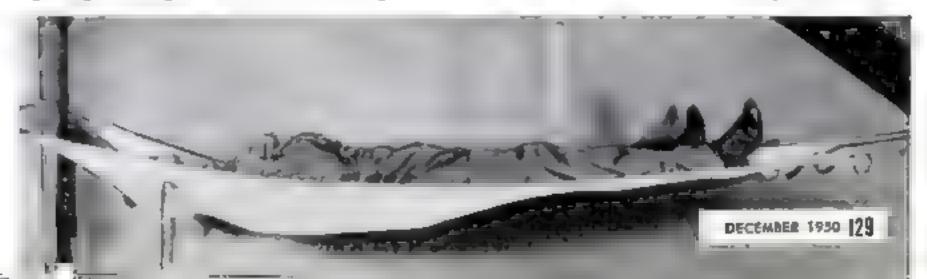
JUNIOR can use his wagon all winter long with this set of runners that converts it quickly into a sled. Made of heavy-gauge steel, the red-enameled runners are attached to the wagon's axles in place of the wheels. They fit all %-inch-diameter axles and are provided with bushings for use on %-inch-diameter axles. Made by the Domestic and Import Sales Co., of Canyon, Texas, a set of four runners sells for \$3.29.



Nylon Hammocks Make Airborne Beds for B-36 Bomber Crews

STANDBY crew members on long-distance B-36 bomber missions can now take cat maps in this new nylon hammock right up in the forward compartment without making the tight-squeeze, pressurized-tunnel trip back

to sleeping quarters in the stern. Made of nylon netting, the 78-inch hammock will support 600 pounds. Adjustable straps at head, neck, and knees let each man tailor the hammock to his own sleeping habits.



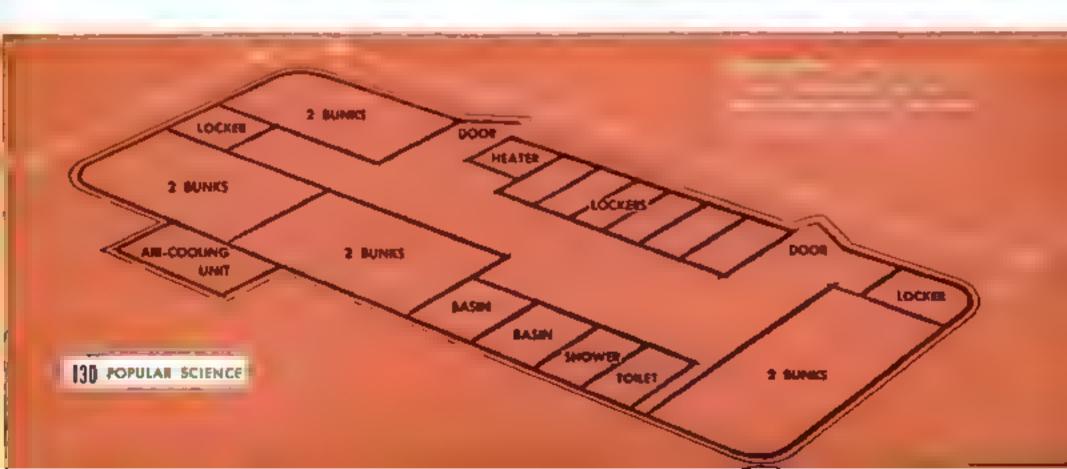


INVENT the wheel? Of course I didn't. Neither did I originate that forlors institution, the boarding house. What I did was to combine the two—and at a profit

It all began with a dirty towel and a twoby-four room I shared with another fellow, for the price of a night at the Ritz. Dirty towels and jumping from town to town are two of the occupational hazards of a pipeline welder like myself who follows construction jobs from Texas to California. But somehow this particular dirty towel sent me into a rage, and out of it came a money-making idea.

We'd just pulled into our second town in a week-somewhere in New Mexico-and as usual room rates started climbing as we approached the city limits. My partner and I found the last remaining room in town, plunked down \$20 apiece for the week, and climbed the foot-worn stairs to bed.

Hanging alongside the old-fashioned



washbowl was a single towel—one towel and two guys to share it. I grabbed it, rushed downstairs, dangled it before our landlady's face, and demanded, "How come?"

"One towel to a room," she replied firmly, "that's all my other boarders get and you ain't no better."

Then and there I vowed that one day I'd have a mobile boarding house, on wheels. Something de luxe we could carry right with us. Something streamlined, ultramodern, and everybody would have his own personal towel, all the laundry and maid service he could ask—yes, and even breakfast in bed!

A few days later I stopped at a trailer dealer and asked some questions. When I emerged four hours later I had dollar signs before my eyes. Half of the dollar signs spelled out profits.

At first the dealer had scoffed at the idea of a roving boarding house. Finally he said I should draw up my plans, submit them to a trailer manufacturer in Chicago, and sit back and wait. I'd either get a horselaugh for a reply or one of the most luxurious stables on wheels.

Next, I visited a local banker who luckily was sympathetic toward trailers. He said he didn't see any reason why I couldn't get a loan, providing I could show a full house

Two hasins and a shower (with plenty of hot water) were planned so that all eight bourders could get ready for work within 45 minutes. Tooth-brusher below is on his last lap.

and a steady flow of rentals coming in. My boarders, I figured, would be guys working the pipe line. We'd all move together and so would our boarding house. But I could see my boarding house would work just as well in a permanent location—say in a trailer camp, or in some deer-filled woods. Or maybe overlooking one of those crystal-blue lakes where trout do fin-flops.

I wanted a compact, self-contained unit,



The author keeps his trailer boarding house sparkling with a daily washdown. Heavy-duty truck tires give better traction on the road and keep trailer from bogging down in the mud.

Built-in individual lockers have plenty of room for both work clothes and Sunday best. Each of the eight spacious lockers is 77 inches high, 21 inches deep, and 15 inches wide.



with everything-showers, bunks, lockers, toilet, washing facilities, heating, and air

conditioning.

The dealer told me that a de luxe, custom-made trailer boarding house as I'd described it would cost from \$4,000 to \$5,000, depending on size and just how elaborate you got. I decided to keep the total cost down to \$4,000 if possible. I'd have to sleep and feed enough boarders to pay the monthly installments—plus making a profit. Eight boarders at \$16 to \$25 a week would pay my bills and fatten my bank account.

Needed: Elbowroom and Kilowatts

Each boarder would need a bunk, individual locker, and there'd have to be enough room so guys wouldn't be falling over one another. There ought to be a window by every man's bunk, and good reading light. And outlets for electric razors and for a radio. Which meant a portable light plant.

What about chow?

The smart thing, I told myself, was to design a big trailer for sleeping and buy a smaller one for myself. I'd sleep in it, use it as an administrative office, and convert half into a combination kitchen and dining room.

When I mentioned my boarding house

idea to a fellow worker, he said I was nuts. "One guy snores," he said, "and it'll sound hke a foghorn in the East River tunnel."

So we'd have to have some soundproofing. Then I hit upon a novel idea. Why not custom-build the mobile boarding house around the men who'd live in it? I began to collect data. I asked 10 men how much clothing and gear they had and converted their answers into cubic feet. I drew up a chart and found that the average height of guys on my crew was taller than the national average. I even discovered how long it takes one of our men to shave in the morning; how long to wash up after work, how many showers he takes a day.

What seemed a simple job at first became a matter of logistics. A statistician would have come in handy.

From my data, I discovered that eight men could live comfortably on 200 square feet of floor space. But how long and how wide should the boarding house be?

Many of the 48 states have their own ideas. Most states say 96 inches is maximum width for trailers on their highways. But Connecticut and Rhode Island allow up to 102 inches. A majority of states specify 35-foot over-all length as maximum. Again



The boarding-house reach is enacted in a smaller. 21 foot trailer that serves as a combina-

tion during room, kitchen, and living quarters for the author. Everybody gets seconds.

there are exceptions: Connecticut allows them up to 45 feet; Minnesota, to 40 feet.

If you want to travel through all the states, you've got to comply with the minimums. Besides, if your mobile boarding house is going to poke around the backwoods, the narrower and shorter the better. So to get the required 200 square feet, and yet stay within the legal limits of all 48 states, I designed the trailer 89 inches wide and 27 feet long. That gave me about 202.5 square feet.

Having queued up outside many a boarding house washroom, I knew that it takes about 20 minutes to wash, brush your teeth, and shave—on the double. Statistically speaking, two wash basins and a shower would keep three men busy simultaneously and turn out all eight boarders, washed, shaved, and in their Sunday go-to-meeting clothes within 45 minutes.

Bunks were designed double-decker, with inner-spring mattresses. Eighty inches of trailer headroom would spare boarders' noggins, even the upper-bunk boys.

Hot Showers on the House

To the average boarder a hot shower is only a tantalizing trickle. My boarding house was going to have a Niagara of hot water.

A poll of three plumbers agreed that a 30-gallon tank, electrically heated, would give us all the hot water we could use.

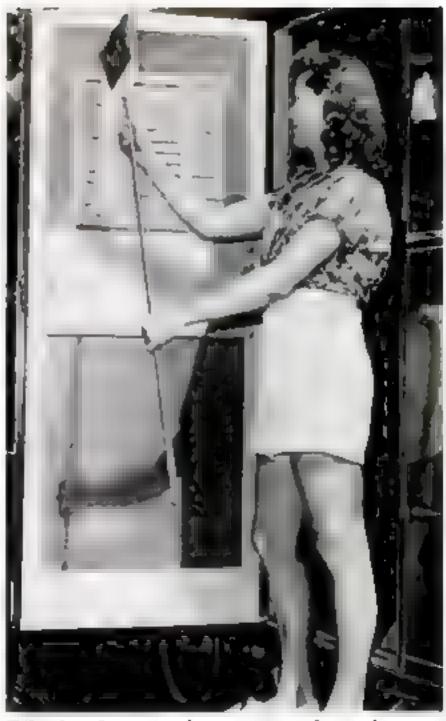
I designed each of the eight lockers to contain approximately 14 cubic feet. That's enough for all a boarder's clothes, boots, and working gear, with enough space left over for a couple of bear traps if he's got the inclination. Six lockers face the wash basins for convenience; there's one at either end of the trailer by necessity.

A centrally located kerosene circulating heater, with two floor outlets to heat from the floor up, was planned.

Since most of our work is in dry, desert country, an evaporative-type cooler would give us all the air conditioning needed. I designed a louvered wall panel so that our cooler could be set up outside the trailer, blowing in cool, fresh air.

Our inside toilet would have to work anywhere. An automatic pressure flusher draining through a two-inch hose seemed to be the answer. In a trailer court, it would empty into a cesspool, elsewhere, we could dig a deep hole for drainage.

Some technical details I decided to leave up to the manufacturer. I specified extra-



What's a home without a woman's touch—even in a trailer? So, a local girl is hired part time at each stopover to cook meals, do the laundry, and keep things spick-and-span.

heavy channel iron for the frame, six-inch stuff instead of the usual four-inch. From two to four inches of spun glass and rock wool insulation between the trailer walls was another specification.

I sketched in my rough floor plans and mailed them, along with a statement that the bank would finance my venture, to the Chicago manufacturer. Instead of the horselaugh, back came the most de luxe mobile boarding house roaming American highways.

My boarders can have breakfast in bed if they want. Laundry goes out twice a week. I've even tucked in bed some of our younger boarders until the guys started calling me "Momecita"—border Spanish for "little mother."

My mobile boarding house is all but paid for now. I've got a steady income. I can see mobile boarding houses springing up all over the country—for sportsmen, touring parties, exploration groups. You won't get rich, but you'll make a decent income and live in luxury.



'51 Ford Holds Same Lines, Has New Radiator Grille

WHILE Ford for '51 has retained the lines introduced in mid-1948, many small styling changes are evident. The most obvious of them is the twin radiator-grille ornament.

Adding to the smoothness of operation

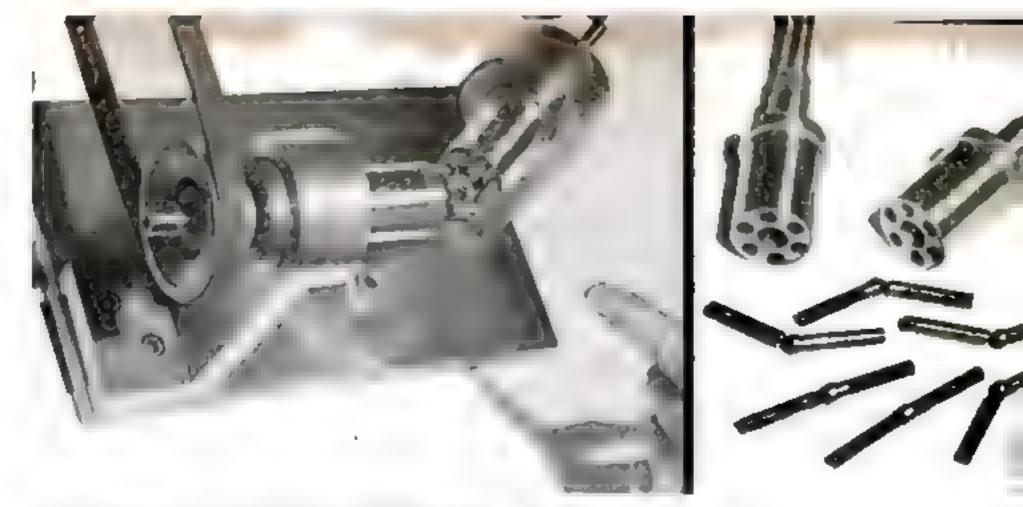
made possible by the introduction of an automatic drive (see page 94) is a reduction of the backward tilt of the engine from 6° to 4°. The engine mounts also have been redesigned to reduce the transfer of engine roll to the chassis of the car.



Rear view of new Ford shows three-lens tail lights and extension treatment of rear fenders. Front seat rides on curved rails in fore-and-aft adjustment, tilting forward for short drivers.



Important dashboard controls are at left so kids alongside the driver can't monkey with them. Turning ignition key just beyond "on" position actuates engine-starting motor.



High-Speed Universal Joint Runs at Sharp Angles

ERNEST A. STARBUCK, 81-year-old Peoria, Ill., machinist, was troubled by the limitations of universal joints. Ordinary ones have parts that operate at varying speeds, setting up wrecking vibrations that limit their use to small angles, low speeds. And the fancy, constant-velocity types are costly.

So Starbuck devised the joint shown above. It consists of two shafts connected by rods fitted into holes in each end. The rods have ball-and-socket joints in the middle that let them bend at a desired angle. When the driving shaft rotates, the rods act as cranks, turning the driven shaft.

The new constant-velocity joint, which its inventor believes can be made for the same cost as ordinary joints, has operated at angles up to 95° and speeds up to 10,000 r.p.m. It can also be used as a fixed-angle drive, eliminating bulky bevel gears.

French Loco Hits 100 M.P.H.

This fast new electric locomotive will soon be speeding passengers and freight over French railways. Hitting up to 100 m.p.h., it made a 146-mile test run from Paris to Tours in two hours and eight minutes-half an hour less than the scheduled time. Weighing 102 tons, the CC7001 is 40 tons lighter than older models. Flexible trucks, incorporating 12 driving wheels, are said to improve stubility at high speeds.



DECEMBER 1950 |35

German Cart Totes Big Rocket

THE strange-looking rocket cart below, captured from the Germans during World War 11, is now helping U.S. rocket experts. Called a Meilerwagon, the wheeled cradle, towed by a truck, carnes a rocket to the firing site, then tilts up, raising the rocket to a vertical position on the launching platform. Here the cart readies a two-stage "Bumper" rocket at the Long Range Proving Ground, Cape Canaveral, Florida.



'Copter Ferry Hops To the Front

A NEW version of a two-bladed helicopter (PS, Feb. '48, p. 165), designed for the U. S. Air Force, can be used as a small troop carrier, ambulance plane, or ammunition ship.

The largest helicopter built by the Bell Aircraft Corp. of Buffalo, it is known as the H-12. It is powered by a Pratt & Whitney 600-hp, engine. The rotor teeter-totters on its hub as it revolves to equalize its lift.

Advantages of the helicopter in evacuating wounded include the ease and speed of landing and take-off, reducing ground time to minutes. 'Copters also can land in areas too small for regular airplanes to use. Hospitals need not be built near specially constructed airstrips.

Doors of the H-12 are 50 by 49 inches. The compartment is 4 feet high, 7 feet wide, and 3% deep. Aft is extra cargo space.



A half-dozen litters for wounded men can be stowed in the capacious interior of new 'copter. Machine weighs about 3% tons, has a cruising speed of 85 m.p.h., top speed of 120.

Helicopter's many jobs in wartime would include movement of squad-sized units to combat Close-up of cabin shows eight intratration with full equipment, plus pilot. Soldiers can disembark in four seconds. Troops are memoers of 174th Infantry, New York National Guard.

areas in emergency operations. Without heavy equipment, 10 passengers can ride in the H-12.





Like an enormous, four-legged bug, 11-12 hovers preparatory to landing. Normal fuel ca-

pacity gives it a range of 500 miles. Aircraft can hedge-hop to avoid circuit bre



Hatch in fuselage belly eases problem of rescue from ground or sea where landings are im-

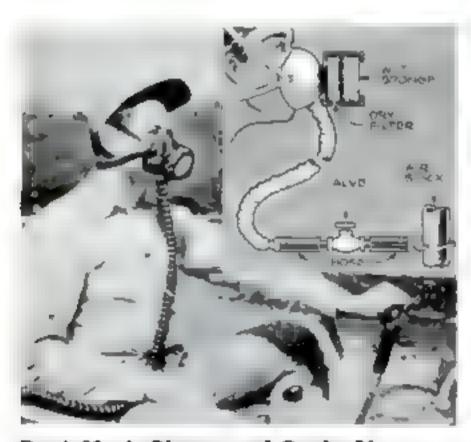
possible. Here a soldier is being pulled upward through hatch by engine-powered hoist.



GIs Get Better Front-Line Radio Communications

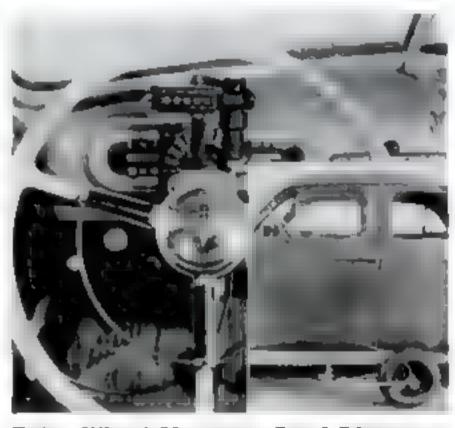
The handie-talkie of World War II has been redesigned (left above) to give improved reception in a frequency-modulated unit that ties in with other Army FM communications. This battery-operated receiver-transmitter has a range of one mile. At right

is a new version of the walkie-talkie. Only half as heavy and bulky as earlier sets, it has a range up to five miles. The new equipment was developed to help knit infantry, armor, artillery, and supporting troops into a coordinated team.



Dust Mask Cleans and Cools Air

Driving a tractor through a dusty field on a hot day is made pleasanter by this dust mask. The inventor, N. E. Gaddini, of Winters, Calif., claims it conditions the air that the operator breathes. The Filtercool mask is connected by a length of garden hose to the engine air intake—the vacuum creating a positive and constant air flow. Air entering the mask is evaporation-cooled by passing through a wet sponge, then cleaned by felt and cotton filters. Stale air is withdrawn by the vacuum.



Extra Wheel Measures Road Distances

An instrument that quickly and accurately measures road distances from a moving car or truck, but which operates independently from the car's wheels or speed-ometer, is now in use by the Minnesota State Highway Department. A 4.00 x 8 pneumatic tire and wheel (inset) is attached to the undercarriage by a telescoping tube. As it turns, distances are registered in feet on a recording head mounted on the steering column and driven by a flexible cable from a drive joint on the extra wheel assembly.



Superbomber Cruises 8 Miles Up

THE B-36 above is shown in one of the first photos ever taken of the giant intercontinental bomber flying close to its top ceiling, which is above 45,000 feet. At high altitude its four auxiliary J-47 jet engines, seen in twin pods slung below the outer wing

panels, are at their peak efficiency to give the bomber an added boost of speed after dropping its bombs over an enemy target. This jet power, added to the six 3,500-hp, pusher engines, gives the Convair B-36 a total of more than 40,000 horsepower for take-off, climb to altitude, and speed bursts in emergency.



Swirling Spray Quenches Pier Fires

THE New York City fireman at right is holding a new Quavle nozzle designed specially to fight fires underneath piers. Shown in action above, the nozzle throws swirling

sprays sideways instead of directing a steady stream ahead. In operation, the nozzle is inserted through access holes in the pier floor. When pressure is turned on, the horizontal curtain of water flares out to battle hard-toget-at substructure flames.

New Toys A Christmas Preview

PS PHOTOS BY HUBERT LUCKETT

HERE are some of the most interesting toys from the 1950 crop that you'll find overflowing the shops this month when you set not to do your Christmas buying for the small fry.

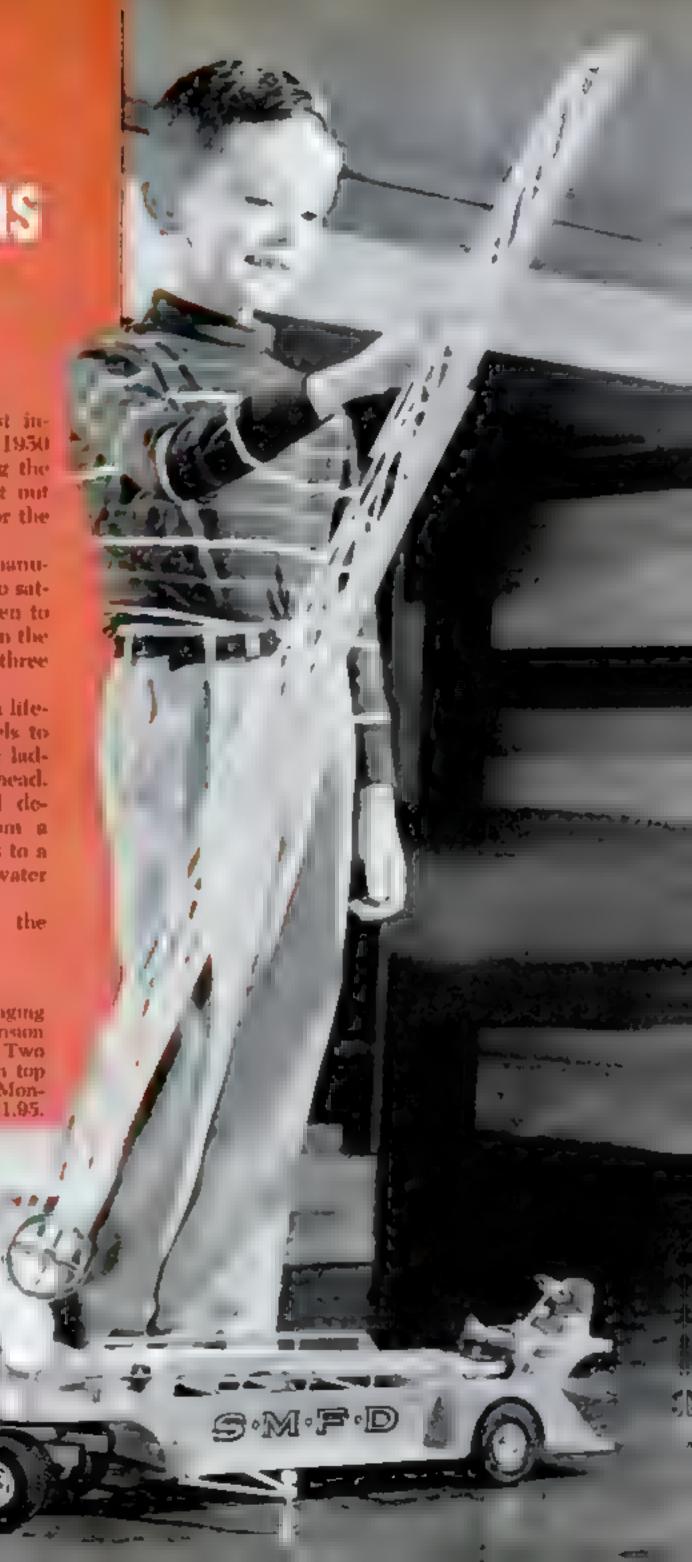
Both American and foreign manufacturers have again contrived to sattify the age-old desire of children to unitate growntips, as you'll see in the toys shown on this and the next three pages.

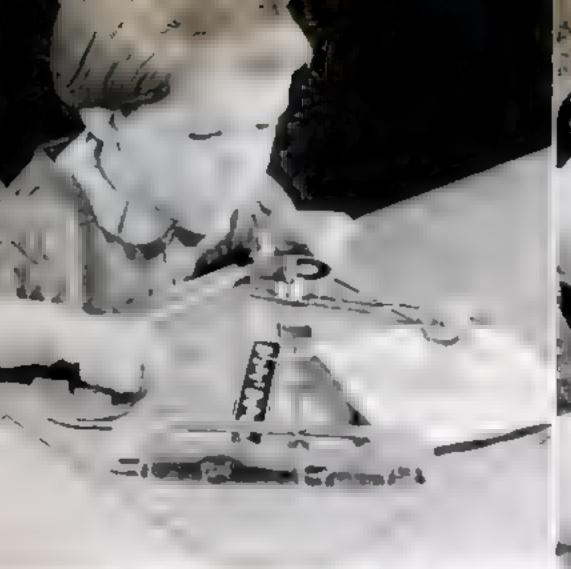
Automotive toys range from a lifelike racer with removable wheels to a fire engine with an extension ladder that climbs over a boy's head. For girls, playthings that will develop domestic traits vary from a realistic doll that cries wet tears to a dishwasher that squarts jets of water over a set of tiny dishes.

Toymakers expect sales for the year to total \$300,000,000,

This fire engine with a free-swinging cab has a four-foot aerial extension ladder attached to a swivel base. Two extra scaling ladders are stored on top of the truck. Smith-Miller, Santa Monica Calif., prices the engine at \$21.95.

40 POPULAR SCIENCE





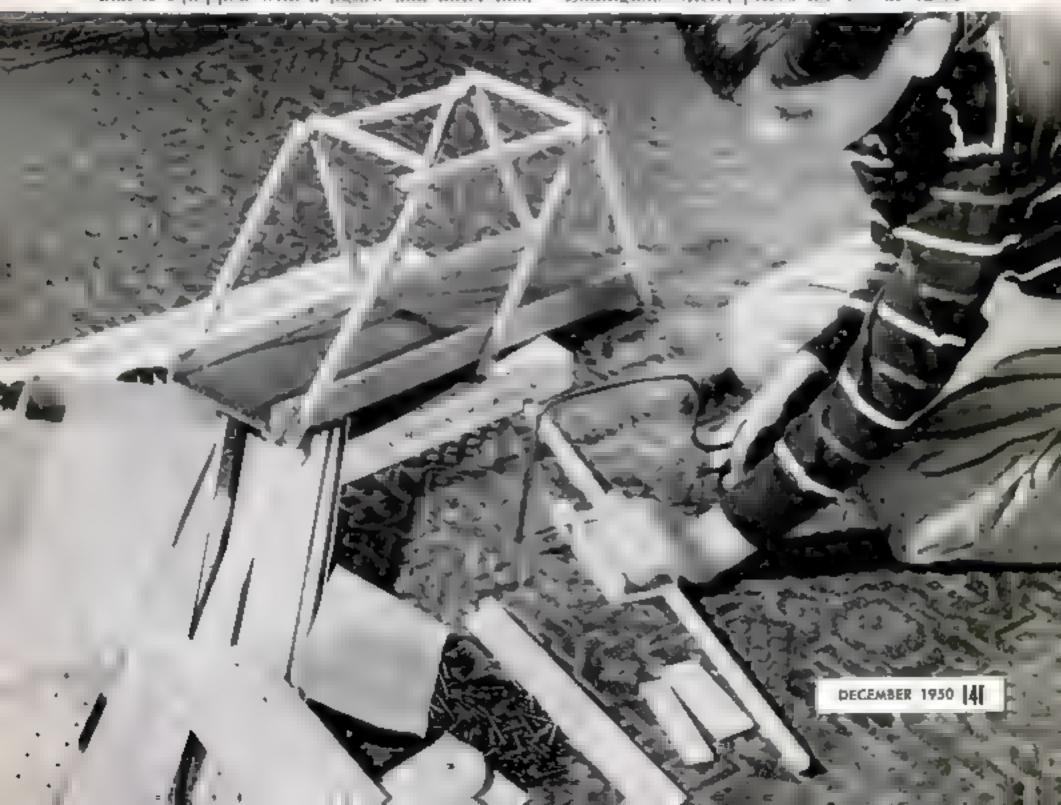
Called Dizzy Doodler, this toy lets a clild "draw" a design on a pad by turning the baratle of the machine. A system of adeistable bars and pulleys activates a tradered drawing head that can make hundreds of symmetrical designs, Carter Craft, Dallis, sells it for \$4.

Junior cute hardwood strips to the length he wants with a hunder construction set chelow) that is equipped with a passw and anter box.



The miniature electric reed organ above has a range of two full octaves. Panaged into an outlet a 1 60th lip, motor powers a blower fan that supplies air for making maste on the instrument. It is made of plastic by Magnus Harmonica Co., Newark, N. J. Price, \$18.75.

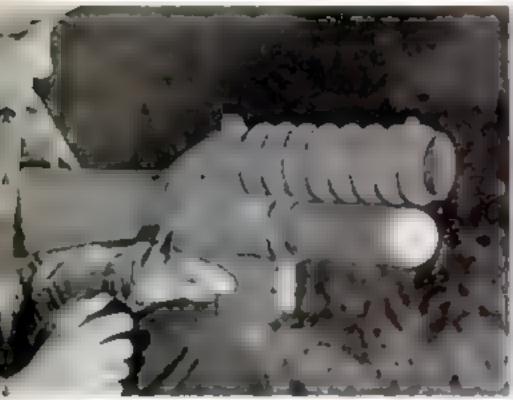
The kit also makides wheels sandpaper, and outs and bolts Carron lad istress for, of Ludington. Mich., prices the toy at \$2.95



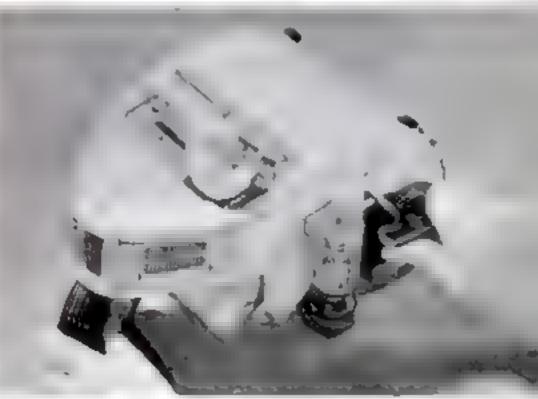


Besides drinking from a bottle, blowing a bubble pipe including for disper this doll cress waters terms as shown above firs forms can be given a bath in I has a safe is to Lord accessories. The tive made by American Contactor Doll Co., New York City, costs about \$12.

Mode in Germany, the 5 lines ricer has removable which end tres A tool K tas displayed in toreground above. The ark motors would be because it has crossed from water on its moderness of the storage front where and a differential gran Price, \$1



The kazooka, a toy bazooka gun fires tableterms halls. Six balls are lorded into the upper incize Each time the gun's crank is turned, a spring is impeed propelang one of the balls but the lower neighbor known inci-Naslaylac, Jenn prices the gun at about \$2.95.



A scale model of a real street sweeper, the windup tev above has rotating brooms that brish the sortace it mus in Two of these are located at the sides of the rigidization one at the back. The rear wheel is steerable, Ny-Lint Tool & Mig. Co., Rockford, Ill., seds at for \$2.58.



The truck above is the miniature counterpart of a full-size one that dumps dart loads from the hottom. Its trailer unfintelies from a coupling

post to allow the tractor to tow other toys made by Doepke, of Rossmoyne, Olno Priced at \$12.95, the truck has steerable front wheels.



Screaming shrilly, this windup Tomic Rocket streaks across the floor on wheels, shooting sparks from its exhaust. Made by Print-O-Matic

Co., Inc., Chicago, the shatterproof plastic rocket, top view shown, sells for \$2.98. A cigarette-lighter flint creates the sparks.



This garden barrow comes from Germany. Its carrying tray has a sifter for separating stones from a load of durt. The tank mounted in front of the toy's body holds water that pours from a spigot, as shown above, F. A. O. Schwarz, New York City, prices the barrow at \$15.



The dishwasher above is a miniature in exact scale of a Youngstown machine. It really works when a bose is hitched to a faucet. Water pressure spins a tube with holes, throwing jets of water on plastic dishes. Mullins Mfg. Co., Warren, Ohio, sells it for about \$13.



Stopped on 30-percent grade, new Mercury with automatic drive starts moving easily in low.

THE most important change in the Mercury for 1951 is the addition of an automatic transmission (see page 94) that eases traffic driving and simplifies the job of starting on hills. With no clutch, you just

throw the selector lever into "Drive" and release the brake as you step on the gas.

Sedans and coupes have a third more rearwindow space. The familiar lines of this year's models have been dressed up a bit.



Snap-on fender shield is an accessory for '51. Standard manual-shift transmission has a new "balanced tooth" design Teeth with coarser pitch are expected to double gear life.



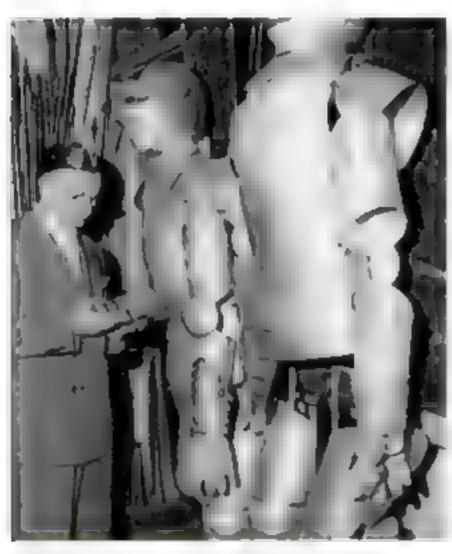
High rear-fender extension makes car look longer and adds to lowness of silhouette Adapted to Ford Motor Co.'s middle-priced car, new transmission is called Merc-o-Matie.



British Jet Fighter Has More Sweepback, Extra Wheel

Possen for take-off, Britain's newest jet fighter, the Vickers Supermarine 535, prepares for a recent demonstration flight at Farnborough, England, Powered by a Nene jet of 5,000 pounds thrust, the slim, cigar-

shaped fighter is said to be one of the fastest planes in the world. Its sleek wings incorporate more sweepback than any previous British fighter. It sports four 20-mm, cannon and a tail wheel in addition to a nose wheel.



Aluminum Armor Lightons Actors

THE next time you see your favorite movie actor in shining armor, he may be wearing shining aluminum. The Western Costume Co., of Los Angeles, Cahf., rents out these special suits of lightweight armor, made of aircraft sheet aluminum, to motion picture studios to save actors from having to wear the heavy, cumbersome, authentic armor.



Britain Gets New Super-Tank

Mounting the heaviest gun ever put into British armor, a 20-pounder, this new 50-ton super-tank weighs 2½ tons more than the U.S. Army's General Patton (PS, Nov. '50, p. 117). Beheved to be the first new tank to go into mass production since World War II, the Centurion will become the standard tank of the Royal Armoured Corps. It is powered by a Meteor aircraft engine. Side plates protect it against antitank grenades.



Three-cornered wing is readied for tryout in Moffett Field wind tunnel. Studies indicate that this bizarre shape, perhaps with flaps added at edges, has great promise for tomorrow's in-

terceptor planes. Triangular craft would have enormous top speed. How it behaves at lower speeds, as in landing, will determine its future as a practical warplane.

Radical new designs being tested in the world's biggest wind tunnel give a preview of tomorrow's planes and missiles.

By Andrew R. Boone

Is IT a bird? A plane? An umbrella? A supersonic craft of the future, streaking through the skies, may resemble nothing you've ever seen before. An interceptor plane, some experts foresee, may be a flying triangle. And it may look like a three-cornered umbrella as it glides to earth, with flaps down on all three edges.

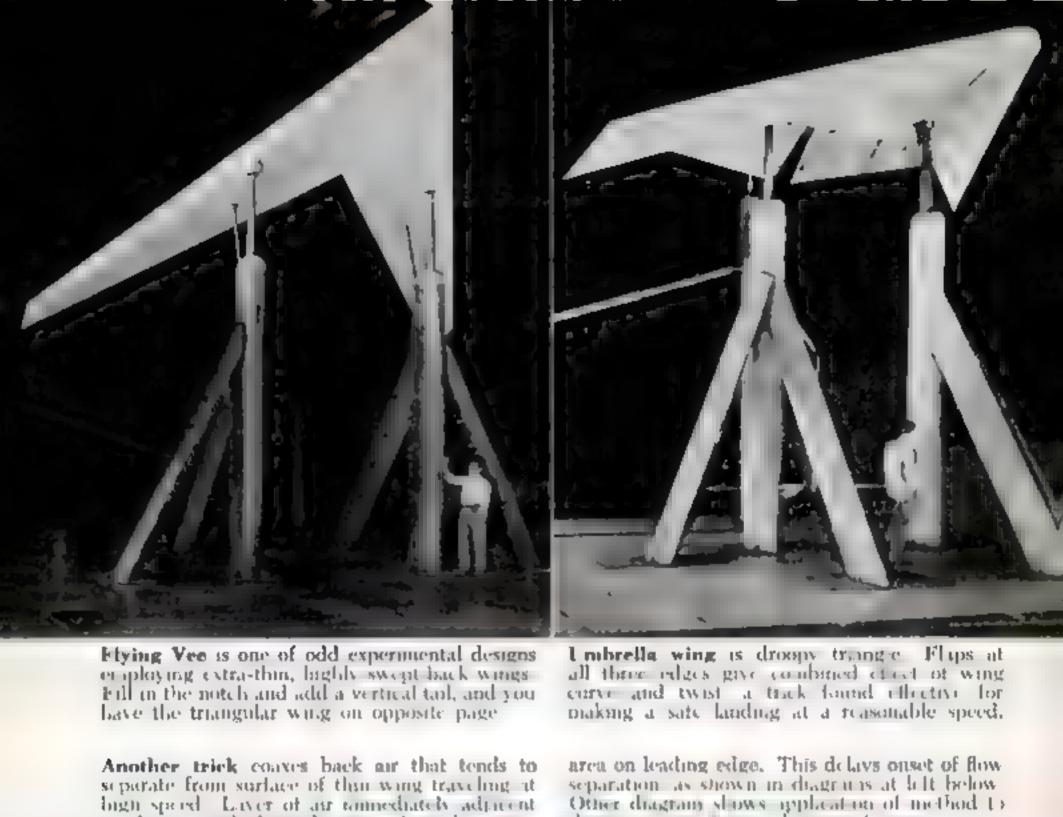
Wings for these planes and missiles of tomorrow are already taking shape in the world's biggest wind tunnel, the mammoth 40-by-80-foot test chamber of the NACA's Ames Aeronautical Laboratory at Moffett Field, Calif. Under test there are full-scale models that look as if their designers had thrown the rule books out the window Some of the fantastic shapes may be the prototypes of planes to come. Others may never fly. But all are adding to the growing store of knowledge on the behavior of wing forms at speeds faster than sound.

Swept-back wings fly faster than straight

ones. But as they lift about half as much, current swept-wing planes must come in hotter and land on runways twice as long. To permit safer landings, the scientists are trying out tricks to improve lift.

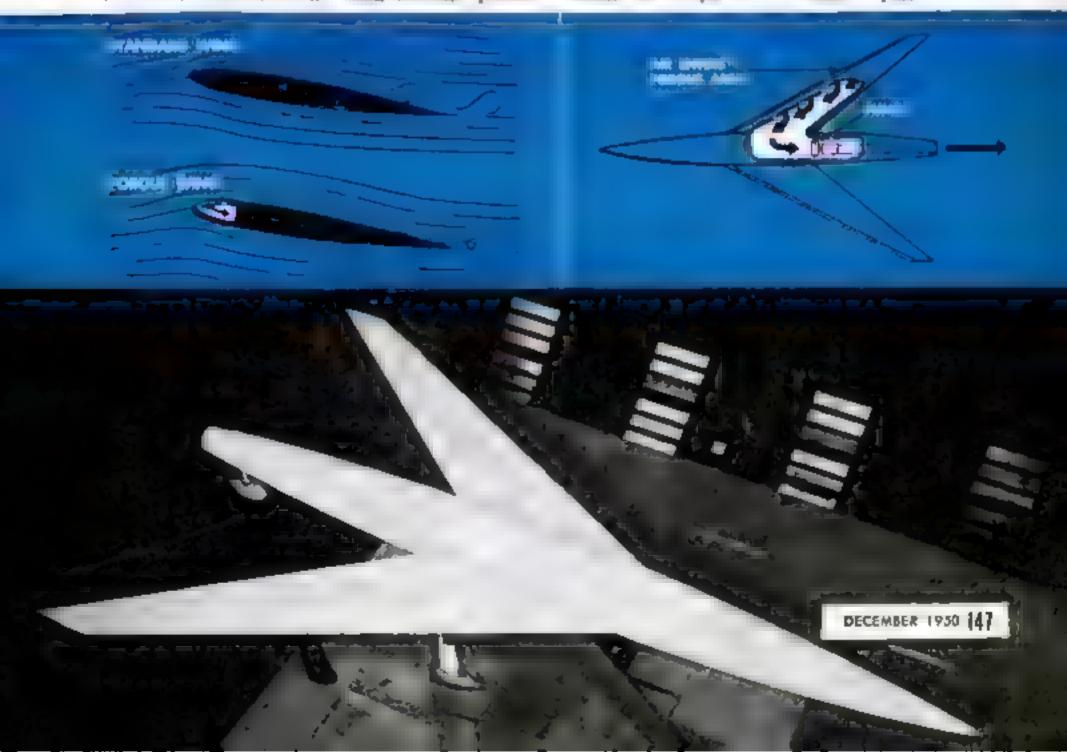
For example, tests show that building camber or curvature into a swept-back wing gives added lift—but not over the entire surface. Curving the wing, and twisting it too, successfully spreads the effect to the roots. But making this wing strong enough would be difficult. Could a similar result be obtained more simply? Desirable effects of camber and twist have been found combined in a triangular wing, with full-span flaps hinged to the leading edges, and a split-type flap at the rear. Odd as it looks, the droopy triangle has the desired ability to land at reasonable speed.

Lift at all speeds would be improved if the tendency of flowing air to pull away from the surface of thin, highly swept wings could be overcome. A wind-tunnel answer is a sucking device to pull air actually inside the wing through a porous leading edge (felt-backed screening was used in the trials). Experimentally, two electric motors powering a supercharger turn the trick.



to skin is sucked aside wing through purous

design in the photo at hottori of page



l'd like to see them make...

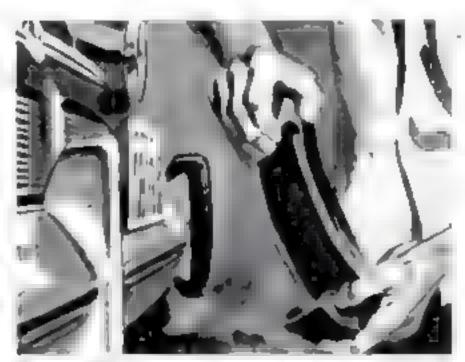
Everyone has his own put idea of some gadget he would like to see to general use. What is YOURS? Popular Science will pay \$5.00 for each one published, Use government postcords only. Contributions cannot be acknowledged or returned.



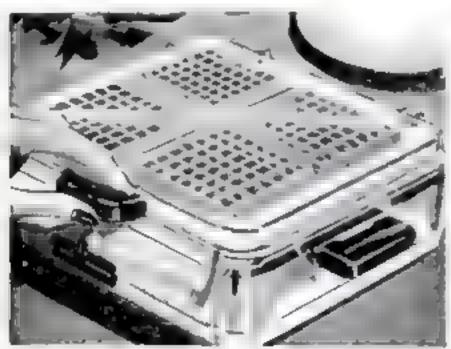
Paint cans with bowl-shaped covers. Such a can would afford ample room for stirring with no danger of paint overflowing the sides. The cover would serve as a color-mixing container. — Michael Venezia, Jr., Floral Park, N. Y.



Magnetic steel tapes for measuring steel or iron pipe for cutting. They would be invaluable for phimbers and steamhtters, making it easy for one man to take measurements.—William Barschow, East Liverpool, Ohio.



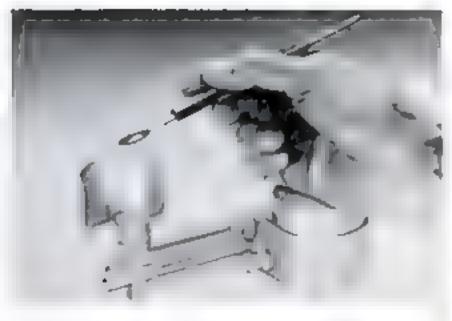
Removable humper guards of hard, tough rubber. Snapped onto the vertical braces of the humper, they would make it possible to push a stalled car (or be pushed) without marring bumpers.—William W. Love, Albemarle, N. C.



Waffle irons with tops of transparent, conductive glass. Expectant diners would enjoy watching the waffles bake and the "chef" could tell at a glance when each batch was done.— Duane Hallan, Hettinger, N. D.



Suction cups on shoe-polish cans to hold them firmly to the floor or shoeshining box when in use. This would eliminate the need to put down the shoe each time to apply more polish to the cloth.—D. Merry, Hillsboro, Ill.



Burner Turns Itself On and Off

Touch the platform of this laboratory burner and the flame shoots up full (above). Take your hand away and it goes off, leaving only a small pilot light. The Touch-O-Matic burner, made by Hanau Engineering Co., of Buffalo, N. Y., can also be locked in the "on" position by turning the platform.



The Twin-Bonanza, a sixplace, low-wing monoplane for business and military use, will be rolling off the production line this spring. Newest in the Beechcraft family of mediumsize planes, it cruises at 191 m.p.h. and lands at 59 m.p.h. on two 260-hp. Lycoming engines. Cabin structure and weight distribution are especially designed for safety.



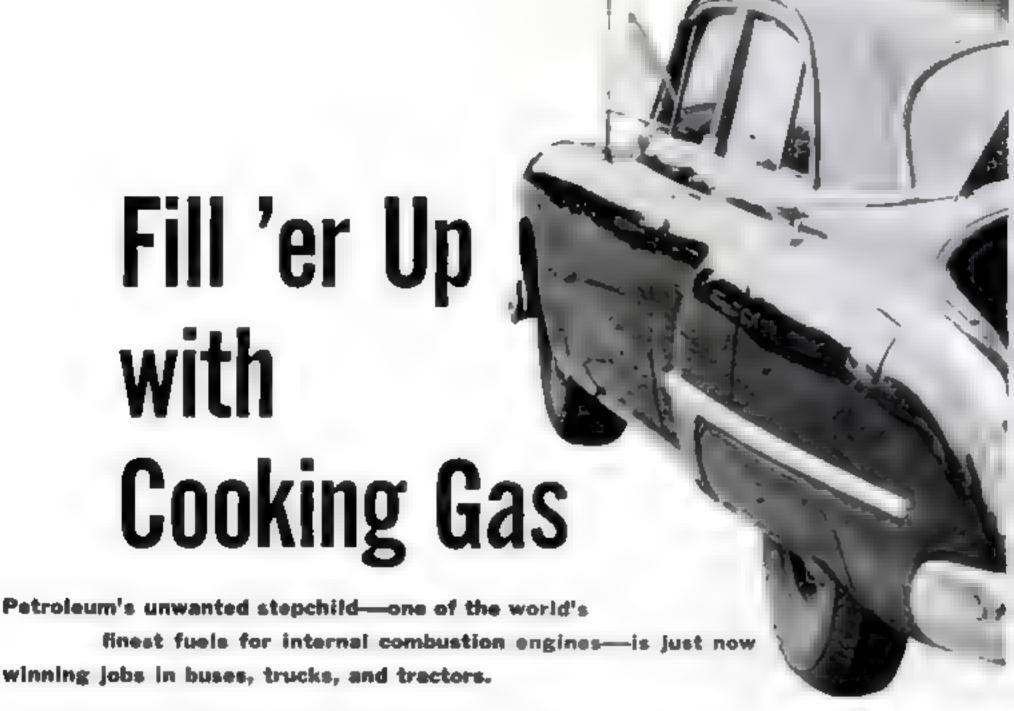
Airplane Towbar Has "Landing Gear"

EVEN the towbar for a B-47 jet bomber has landing gear. The 29-foot-long bar, partly supported by its own small wheels (above), simplifies ground handling of the big Air Force plane. Boeing engineers designed it to be broken into segments and carried inside the airplane.



Dump-Truck Attachment Drives Fence Posts

THE hydraulic lift of an ordinary dump truck drives fence posts when this attachment is added to the truck. The Nelson Post Driver consists of a steel cable, a set of pulleys, and a steel cap that fits over the post. As the dump body uses, the cap pulls the post down into the ground. The cutaway sections of the pictures at left show how the pulleys work. Rosenwald-Cooper, Inc., of St. Paul, Mmn., the manufacturer, reports the device can set 100 snow-fence or farm-fence posts in an hour.



By Devon Francis

On THE Texas Gulf Coast there are some men who would give a fortune to anyone who could tell them how to get rid of a lot of high-octane motor fuel. There, and in California, Kansas. Oklahoma, and Louisiana, there are at least 450,000,000,000 gallons of the stuff in the ground. And much of that taken out goes begging.

Now a start is being made on using this fuel—the oil industry's unwanted stepchild, liquefied petroleum gas—as a substitute for gasoline to conserve the nation's oil reserves. If war should come, with a considerable diversion of gasoline to military use. LPG—as it is known—could be a godsend to the trucking industry and its 7,700,000 vehicles. Someday you may even be using it in your own car.

For LPG is one of the world's finest fuels for internal combustion engines. It won't ping. It burns almost completely. Its residue comes out of the exhaust pipe practically odorless. It won't form carbon. It's a guarantee against almost all crankcase oil dilution. And it's cheap.

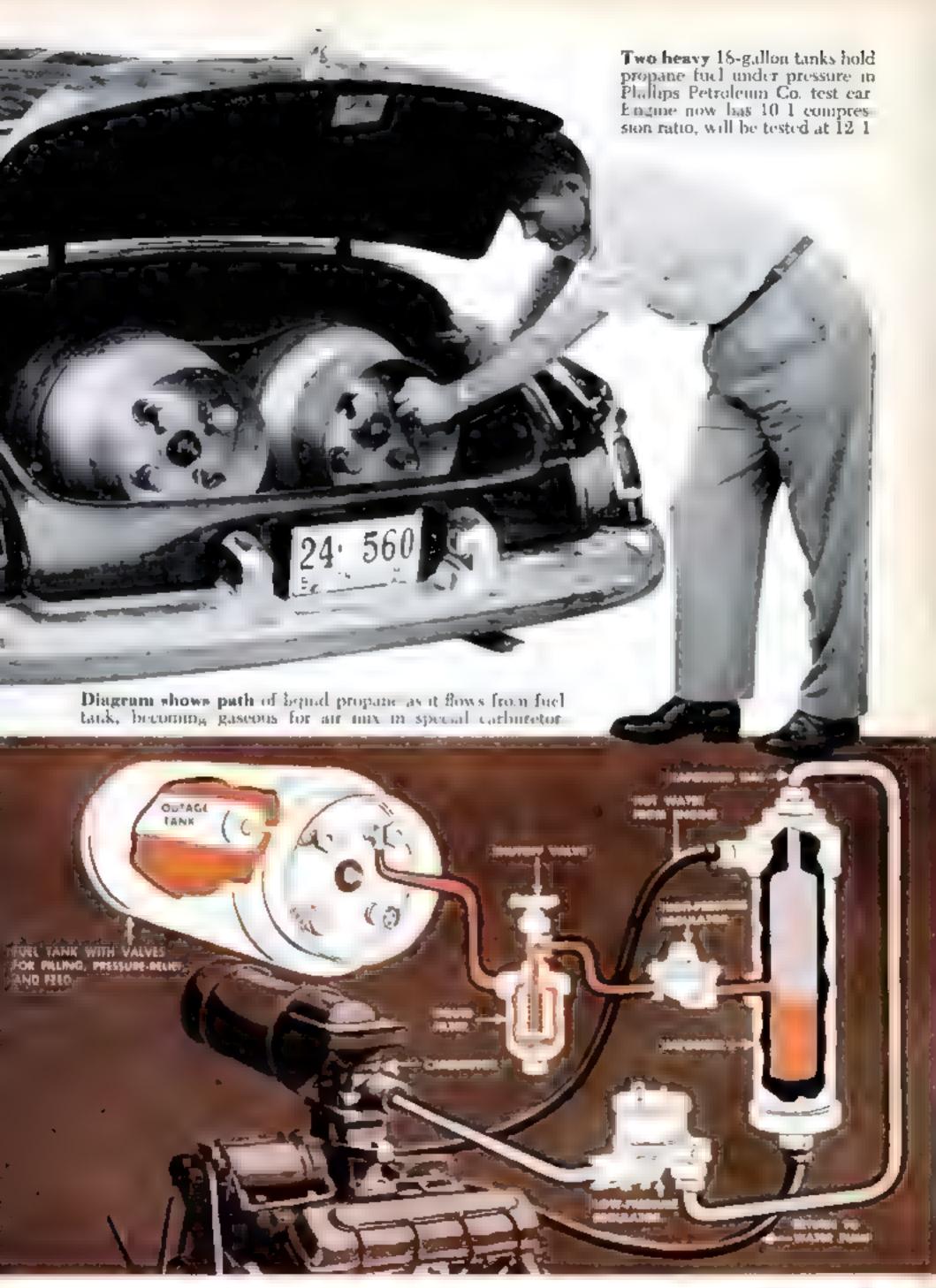
But few people want it. They don't want it because there's a catch—the motor vehicle using it has to tote around a heavy tank to carry it and must have a special fuel system.

"Bottle gas," as LPG is known to the consumer, is used for cooking on tens of thousands of American farms. It's bottle gas that is used in Pullman air-conditioning systems. It was bottle gas that powered the engines of Germany's Graf Zeppelin before the war. LPG, in fact, has been used freely as an engine fuel in farm vehicles and trucks for many years in the U.S.

LPG = Butane + Propone

LPG's chief ingredients are two separate gases, propane and butane. Butane is the stuff that's added to your gasoline at the refinery each winter to make your motor start easier. It's butane that's burned in those new-fangled eigarette lighters that require a filling only once a month.

Neither propane nor butane is easy to

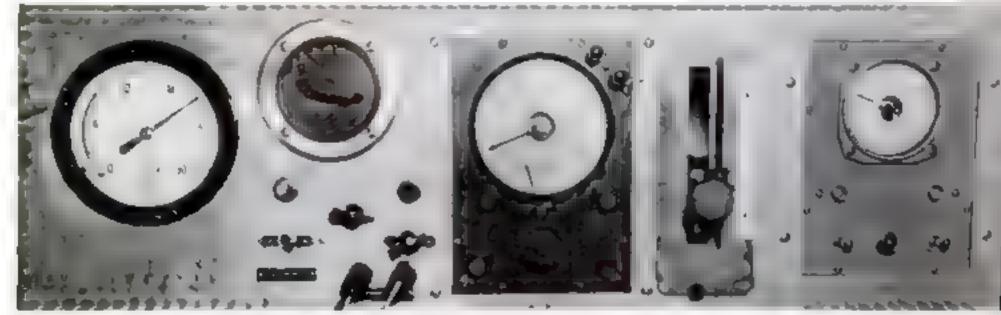




PS reporter Devon Francis tries unsuccessfully to detect puring in propane-fueled test car Earphones unplify signals from detonation pickup on high-compression engine.



Maze of additional equipment and piping is required under hood of engine converted to the inel. Propane-fueled vehicles have safety valve crosing tank if engine stops or a line breaks.



Instruments on dash of Phillips test car report engine speed and temperature, manifold pres-

sure. Lever at right controls the spark adjustment. Wires at bottom are for the knock meter

handle. They're as volutile as a redheaded Irishman and have to be kept under pressure to make them stay in liquid form.

Of the two gases, easily separated from each other at the refinery, propane is becoming more and more a specialized motor fuel.

The biggest convert to propane in recent months was the City of Chicago which ordered 500 propane-propelled bases. But even if every bus in the United States started burning propane tomorrow, they wouldn't use a sixteenth of the country's annual capacity.

Propane is a "distress" fuel, as they say in the oil business. Most of it comes from natural gas, LPG has to be taken out before the gas is piped cross-country from the wells. Otherwise it condenses at pipe-line pressures and fouls the mains. As more and more natural gas is taken from the ground to meet a fatter demand, the propane taken out collects like newspapers in an attic.

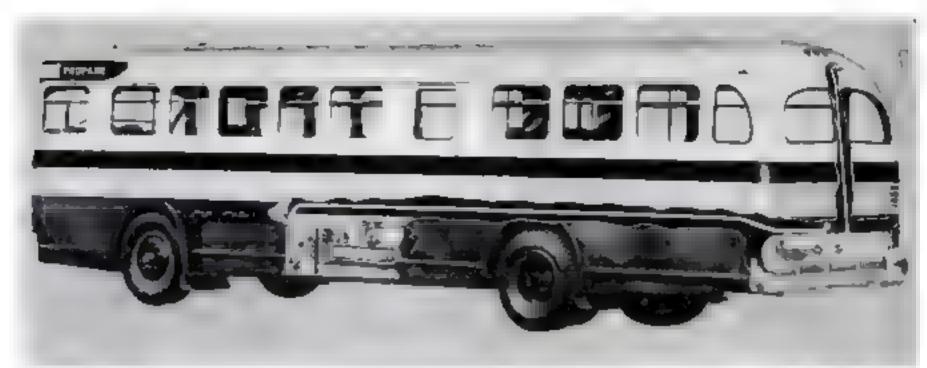
LPG is, like petroleum and the products associated with it, a hydrocarbon—it consists of hydrogen and carbon atoms. LPG contains about 60 percent propane, 40 percent butane, and a negligible amount of isobutane. This is the way a chemist describes propane:

ннн н–С–С–С–<u>Н</u> ннн

And this is butane:

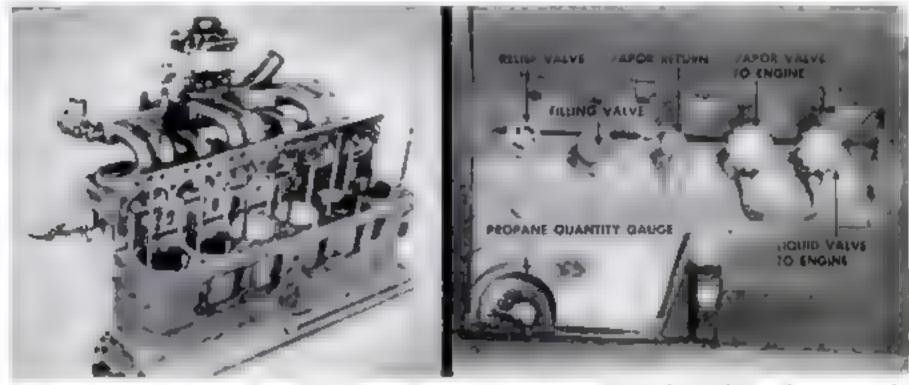
нннн н-С-С-С-С-Н нннн

Propane has a much lower boiling point almost down to -44° F than butane. Released from the pressure that keeps it liquid,



Cutaway shows propane fuel system in new Twin Coach buses. Slow-speed engine produces

195 hp. at 1,400 rp.m. It has 451 cu. in. displacement, a stroke of 5 m., bore of 4% in.



High-compression engine for Twin Coach has patented oval-shaped combustion chamber to relieve bearings and crankshaft of some of extrahigh pressures generated by burning gas.

Propane fuel tank has safety valves, controls. In rehling, nozzie automatically closes "outage" tank inside main tank, thereby providing expansion space for gas in hot weather.

butane will absorb heat so fast that it will freeze water. But propane will freeze mercury. Propane has more comph when put in a motor. When you get above 100 octane, fuels are given "performance numbers" instead of octane ratings, so oilmen generally credit propane with a 125 performance number as an anti-knock rating. That's 25 points higher than most aviation gasoline.

Butane, by the way, is also a source of aviation gasoline when two hydrogen atoms are knocked off the molecule to form butylene. Another derivative that plays an important role in industry is butadiene—butane with four hydrogen atoms knocked off—used in synthetic tire rubber.

About two gallons of LPG can be recovered from the average 1,000 cubic feet of natural gas. Liquefied petroleum gas also comes from crude oil—about a tenth of a barrel of it to every barrel of crude brought in.

America's great poverty of riches in LPG and propane lies in its vast natural gas reserves. Those now known amount to 180,000,000,000,000 cubic feet. More than half of that is on the Texas Gulf Coast. That's why Texans would like to get rid of more propane-profitably. The only reason propane isn't burned more generally is the difficulty in handling. It must be transported to distribution points in special pressured tanks. Special nozzles are required to refill a vehicle's propane fuel container. A propane-propelled truck, bus, or tractor must have a special pressure-reducing distribution system leading from the fuel tank to the carburetor because the liquid must become a gas before it can be burned. The carburetor itself is a special job, without a float bowl or needle valve. It merely acts as a mixer for air and gaseous

propane.

And propane demands a high-compression engine for performance. The Twin Coach Co. of Kent, Ohio, leading manufacturer of propane-burning buses, uses a 10-to-1 compression ratio. The highest ratio used in production automobiles so far is 7.8-to-1.

While propane is sold in every state, it's harder to get than gasoline. You can't just run down to the corner filling station.

But fleet owners find the results well worth the investment in specialized equipment. First off, propane costs in mid-continent, where most of it is produced, a fourth to a half less than gasoline. It is 10 to 40 percent cheaper than Diesel fuel

Propage is a clean engine fuel. One California fleet owner has a truck he runs 90,000 miles between overhauls compared with the 30,000 he ran with gasoline.

Burned propane leaves no spoor like Diesel oil or gasoline. Vapor locks are unknown. Because it burns more slowly than gasoline and more progressively, it exerts a steady pressure, like steam, against the piston head—so wear on bearings is reduced. And finally, propane whips the bugaboo of carburetor engines—an unequal distribution of fuel among the cylinders. With propane, each cylinder gets a like charge of wholly dry gas.

While the Phillips Petroleum Co., of Bartlesville, Okla., the world's biggest producer of liquefied petroleum gas, would be the last to deny it can be dangerous, serious accidents have been few. The strength of propane-burning vehicles' fuel tanks almost obviates unhappy results in the event of

collision. Locks and valves in the fuel system are designed to prevent accidents.

The Phillips people go further, and they ought to know what they are talking about. They pioneered the utilization of the gas when natural gas companies were letting it evaporate to solve the problem of disposal.

They say that even in the unlikely event of a tank puncture in a highway crash, the gas usually vents and burns if ignited, rather than exploding. A Spokane motor coach company operated a fleet of 133 vehicles on propane for 10 years for a total distance of 40,000,000 miles with virtually a perfect safety record.

LPG a Veteran

Propane isn't new. Or, rather, LPG isn't new. It was known at the turn of the century, and back in 1914 a car was run on it in New York City. There are several dozen private cars using propane today. All told, close to 200,000 trucks, buses, farm, and earth-moving machines are today burning propane or a propane-butane combination.

During a visit to Bartlesville I climbed into an Oldsmobile propane test car to see how it felt on the road. The car had a 10-to-1 compression ratio and presently was to be tried out at even higher ratios. I saw no difference between its performance and that of a standard Olds using Ethyl gasoline, but for one thing: I couldn't make the engine ping.

As I slid out of the seat after the drive I asked a Phillips executive, "I don't suppose this stuff ever will be used in private cars?"

He rubbed his chin. "I'd hate to bet money it wouldn't," he replied.

Farmers are converting tractors to use "bottle gas" because it's cheaper than gasoline. The

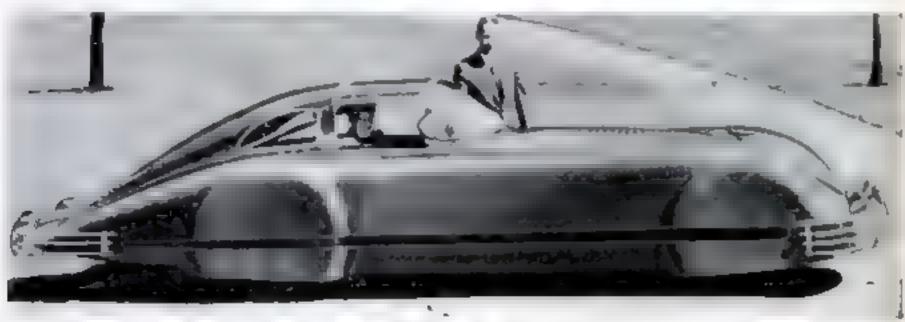
tank on front of this machine contains the same gas as is used for cooking in farm kitchens.





Earth-moving equipment is being powered by natural gas by product. Here at Garrison Dani

on Misseum River below Fort Peck, Mont, tractor-truck has motor adapted to propane



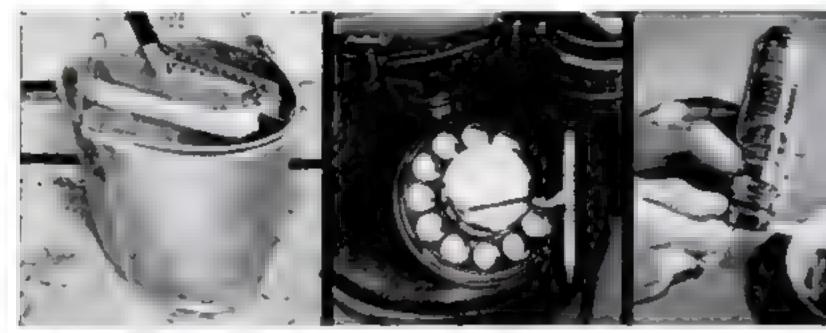
L. J. Fageol, president of Twin Coach, drives this 275-lip, propane sports car. Specially built

for have car has 10.1 compresser ratio and has been clocked in test at 135 in p.h.

Latest wrinkle in cargo carriers is this motorized grant powered by propane engine. Caseven has been used by an Oklahoom carboretor company to run a 4-passenger light airpline.





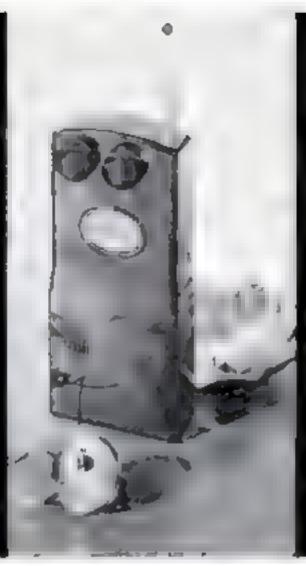


Pail Has Oval Shape. Designed to accommodate wide sponge-rubber mops, the oval pail above has a bottom shaped so it won't topple off stairs or ladders and spill the contents. Nesco, Inc., of Milwaukee, Wis., introduced the new tip-proof wash pail.

Memo Pad Fits Phone. Messages can be quickly jotted down on paper disks in this refillable pad holder that clips onto the center of the dial. The pad, including a pencil, is priced at \$1.25 by Dial-O-Pad Corp., Brooklyn, N. Y.

Midget Extinguisher. Unlike many fire extinguishers, the pocket-size Presto above has a shut-off valve that permits it to be used more than once before it has to be refilled. It's sold by Lewis & Conger, New York City, for about \$4. Refill costs \$1.85.





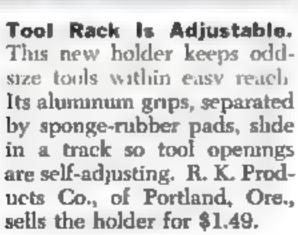


Plastic Saves Lotions. Creams and lotions packed in a surtease are less apt to spill it carried in the unbreakable, flexible polyethylene containers fitted into this cosmetic case. The set is priced at about \$3 by Simmons Kit Co., New York City. The plastic case resists abrasion.

Radio Has Button Earphone. Instead of a bulky
headband, this pocket radio has a hearing and type
of ear plug for listening
The set is turned on by
pulling out its telescoping
antenna. Privat-ear Corp.,
The Bronx, N.Y., prices
the receiver at about \$24

Tube Switches on Lamp. To light this floor lamp, just give its shaft a twist to the right; to turn it off, twist it to the left. A special toggle switch hidden at the top of the tube permits this action. Made by Calpa Products Co., of Philadelphia, Twist-A-Lite is priced at about \$26.







Coaster Blots Drips. Iced drinks won't drip if the coaster above is fastened to the bottom of a glass by its suction cup. Made of plastic, the coaster has a blotter to absorb moisture. Bates Products, Burbank, Calif., sells eight for \$1.



Can Punch Pries, Too. Besides having punch prongs for making large and small holes in cans, this opener has a screwdriver tip that pries lids off containers. Available from the Punch-a-Can Co., of Canyonville, Ore., the tool is priced at about 40 cents.



Brushed on essement window, Zinkrich acts on metal to form rustproof, galvanized surface.

Rustproof Compound Can Be Brushed On

IN THE constant battle of iron and steel against corrosion, zinc, the hero of the galvanized pail, has become an established favorite. But to apply its protective coating required an elaborate method of hot-dipping the object to be protected in a bath of molten zinc. Now you can get a cold-galvanizing

Two steel strips, one coated with Zinkrich and other bare, are immersed in salt solution. Millivoltmeter reading shows that current is set up by chemical action between strips. Similar action occurs between Zinkrich and any iron or steel surface painted with it, locking coating on.

compound, called Zinkrich, that can be applied by brush, knife, or spray.

Developed in England and distributed in the U.S. by the Zinkrich Co., of New York City, the new compound consists of 95 percent finely ground zine dust, suspended in an electrolytic fluid. When applied to iron or steel, an electrochemical action takes places that arrests the spread of rust and binds the zine to the base metal by galvanic action.

Except for small articles and thin sheets, treated in quantity, the new material is cheaper than hot-dipping and can be applied in any thickness desired. Uses range from ships to the homeowners' casement windows and include steel fences, fire escapes, gasoline tanks, auto bodies, machinery, threaded pipe, and any household objects subject to corrosion.

Surfaces to be treated should be cleaned of grease, paint, dirt, loose rust, or scale. Large rusty areas should be cleaned to the bare metal every foot or so to provide an "anchor" for the compound. Spraying with water an hour after application reveals any weak spots, which can be recoated. The surface becomes hard enough for heavy use after 48 hours.

Keeping the Home Shipshape



Save cardboard cartons of a single size until you have enough to fit together on your closet shelf. Covered with cold-water paint, they provide neat storage for hats and handbags.



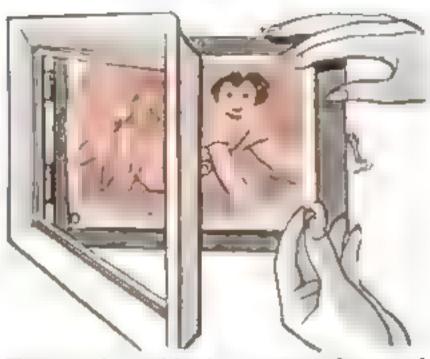
Attach a receptacle under your ironing board and connect up some heavy-duty wire as an extension. Then you won't have to set up the board so close to an electrical outlet.



Do your children scuff the tips of their shoes? Try brushing several layers of sheliac over the tips after shining shoes. This helps hold the gloss and protects the leather.

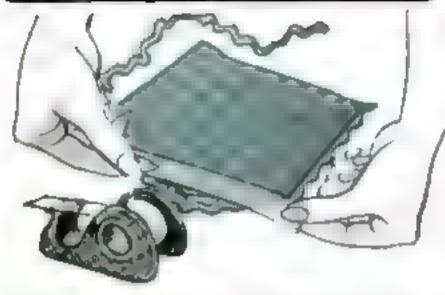


A hard maple board makes a fine top for any kitchen working surface. If you can't find a board that fills the whole surface, piece it out with some pine of equal thickness.



Hinge a plywood back to a picture frame and you can change pictures without removing the frame from the wall. Paste the mat on the glass and thumbtack pictures to the plywood.

Keeping the Home Shipshape



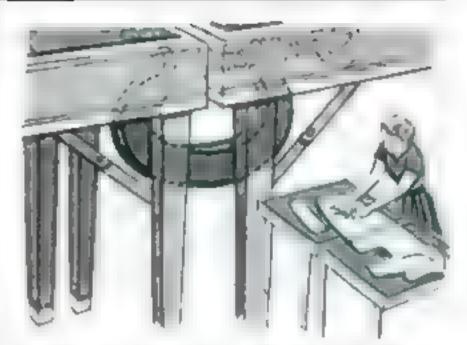
Don't haste when using rickrack or lace to trim. Use cellulose tape to hold it in place. When you machine-sew, you can see through the tape, which is easily removed after stitching.



Worn spots on a rug, showing white stitching and exposed seams, can be concealed by careful tuning with fabric paints or photo-coloring dyes mixed to match the rug.



If you reissor your steel-wool pads in two, you'll heat the rist bugaboo. The smaller pieces are big enough for any scouring job, but discards from rust will be halved.



A pair of card tables, clamped together underneath with two C clamps, make a fine cutting table. Removable wooden lifts will raise the tables to a convenient cutting height.



Your floor-painting and repairing jobs will be easier if you have a movable kneeling pad. Just

add custers to a block of wood, pad with foam rubber, and cover with a tough plastic.



Lights Out of Doors Say Merry Christmas

By R. L. Biesele, Jr.

Head of Electrical Engineering Dept ,

THE owner of the house shown above lighted it up for Christmas in all four of the most popular ways. He not only outlined the house, but also silhouetted the shrubbery with his lights. Then he added both a Santa Claus cutout and a Biblical scene

In one, two, three, or all four of these ways, your home, too, can be made so attractive that people will go out of their way to see it. Look how charming and inviting the holiday lights make the plain little house at the right.

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On the next four pages you'll find suggestions and explanations of how you can make your home. Ing or small, old or new-sparkle on Christmas Eve

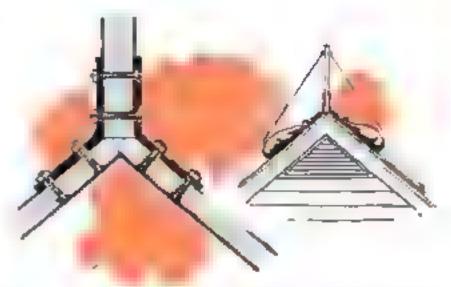


Outdoor lighting need not be expensive.



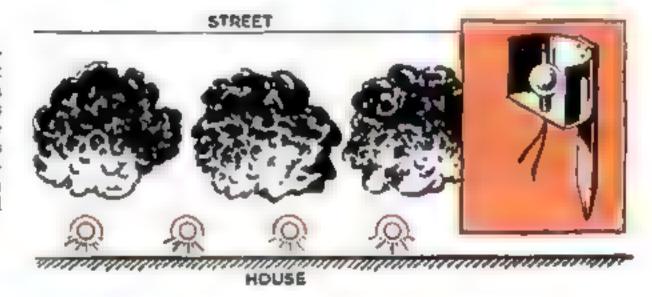
Cutout figures like the Santa Claus at left can be made of wallboard, painted, and then outlined with colored lights. Drill holes to fit sockets and screw in bulbs from the front, Keep in mind both the day and night appearance of your work And he sure to use outdoor lights. A stake in the ground will hold this cutout upright





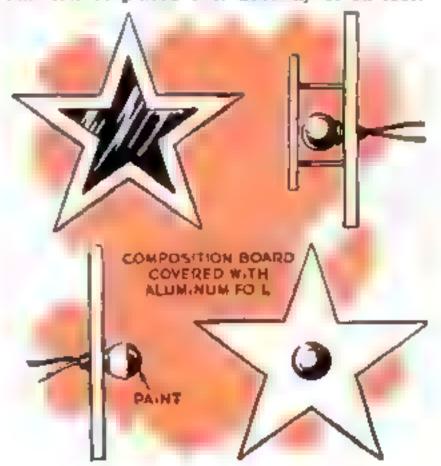
A cutout can be mounted on a peak or gable without nailing into the roof by putting it on a simple wooden saddle. Its legs should be twice as long as cutout is high. They can be holted to the upright with bent angle brackets. Sandbags can be used to add weight and guy wires or ropes to make the cutout sturdy.

Shrubs and trees can be silhouetted by directing light at house. Shield bulbs on bush side with halves of coffee cans cut vertically. Wrap tape around weatherproof sockets to hold them in holes in bottom of cans. Then festoon trees with bulbs, and they'll really glitter.



Lights outlining home can hang from permanent hooks, spaced so the wind doesn't bang bulbs against a wall. Wire should be hung by tape or cord loops so that it will not rub against the metal. Many decorators prefer to support the wires on porcelain insulators. Warning: Never drive nails through the wires.

A lighted star nearly always helps. Two ways to make one are suggested by sketches below. Star can be placed over doorway or on roof.



Wiring the lights right is as easy as 1 - 2 - 3.



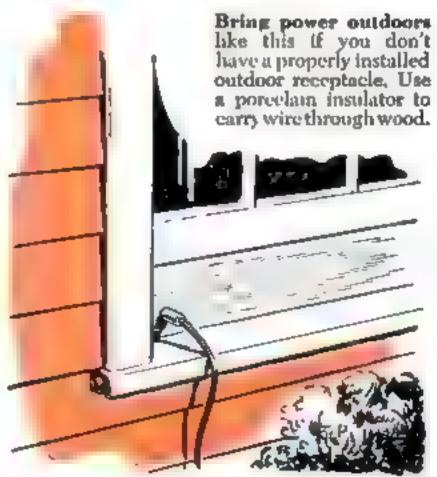
Use the underwriter's knot, shown above, whenever you attach a plug to your wire. This knot helps keep wires from pulling loose at screws. And when you splice wires, hare enough of each one to make a tightly wound splice. Stagger the splicing, as shown in sketches at right, then wrap tightly with electricians' tape.

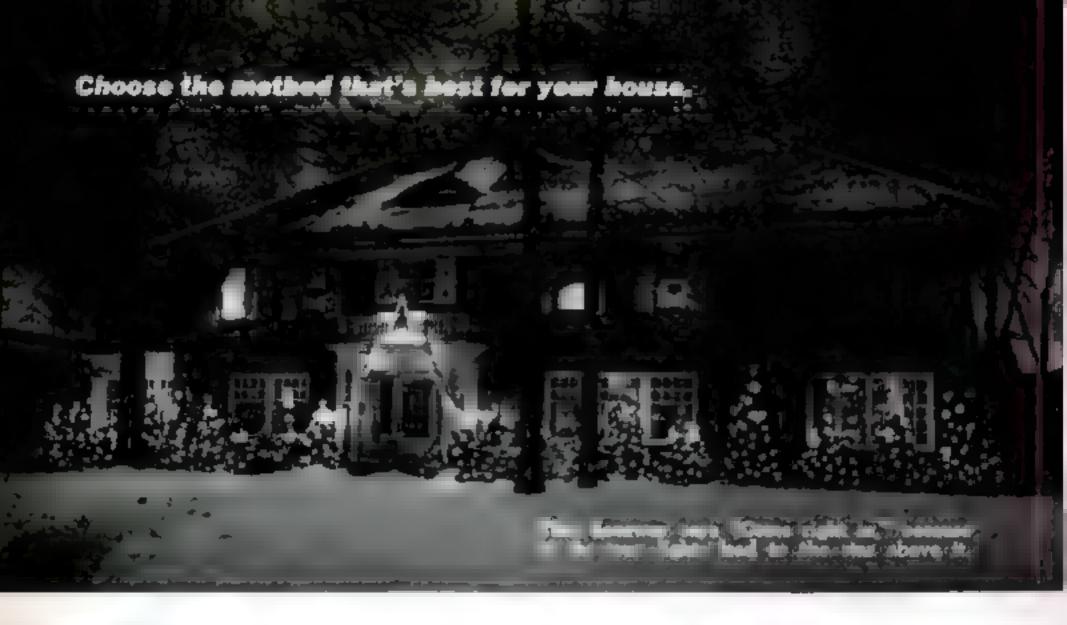




Wentherproof holders are required for flood and spotlights. Two adjustable types are seen here. With the kind in center you can use a lamp with built-in reflector. If available, a color cap over the lamp will enable you to produce some novel lighting effects.

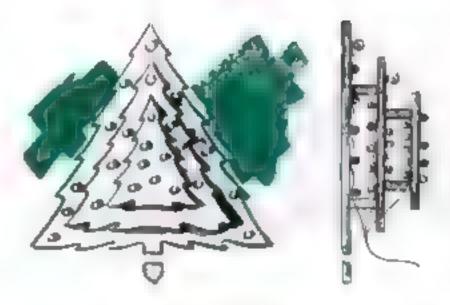








Candles at the doorway. You can make a pair of big ones from stovepipe or downspouting. Nail a wood disk or similar support into the upper end of the pipe for a socket and 150-watt floodlamp. Shape a flame from heavy foil, backing it with composition board if necessary. Paint pipe red and floodlight the door



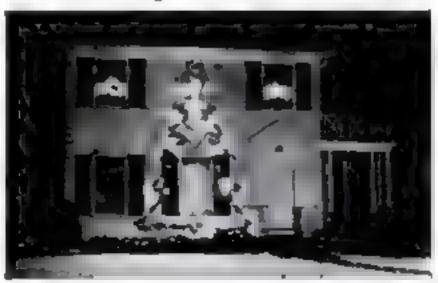
No trees in your yard? Make your own. Triangular shapes out from composition board will do the trick. You can use just one triangle—or several as above. Press the sockets into holes in the board and put the wires behind Paint trees flat white or dark green. Pieces of foil or bin can be used behind the bulbs.

Santa and his reindeer ride the sky in the photo below. This dramatic cutout was put up and lighted by cooperating neighbors.



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Evergreen branches tied to wires on the front of this home form a Christmas tree that frames a window through which indoor tree is visible.





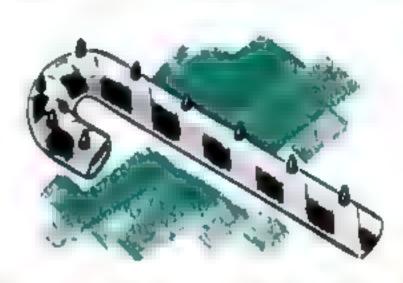
A shadow picture can be obtained by placing a floodlight in front of a cutout. Position the light and cutout so the shadow will fall on a plain part of the house. Cutouts similar to this can either be made or purchased in the stores.



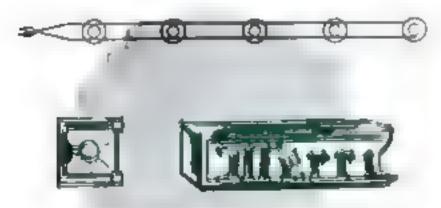
A floodiamp in a tree lights up Santa Claus cutout on a garage door in this case. A garage door frequently offers a good background for achieving spectacular Yule lighting effects. A floodlight has twice the spread of a spotlight,



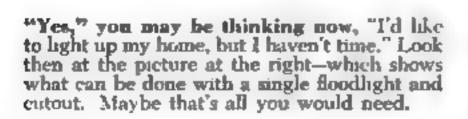
A wreath around the door can be made by covering chicken wire with layers of evergreens. Dot the wreath with bright red lamps. To really impress the neighbors, throw a 150-watt incandescent floodlight on your wreath.

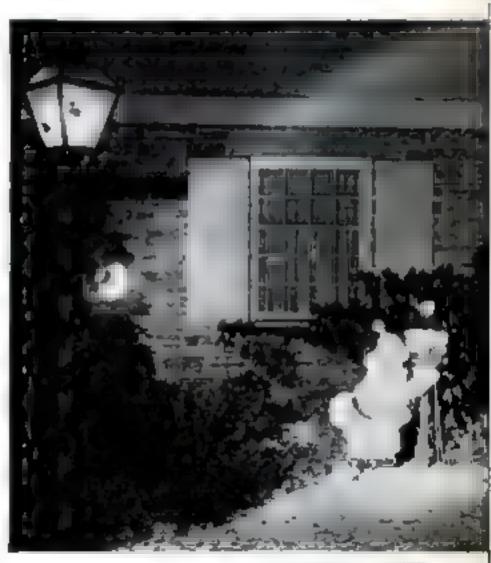


Hoge perpermint candy cane consists of sections of downsporting. Wrap strips of red and white oilcloth around it. But bulbs through drilled or punched holes, leaving sockets and wire inside. Hang it from a tree.



An electric sign is always a good bet. Make it by building a narrow wood box and putting glass in slots on one face. Wire porcelain sockets as shown about six inches apart. Use 25-watt bulbs of the same color. Paint glass and inside of box white. Lettering can either be painted or cemented on the glass.





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From Readers' Albums of Television Photos

THESE are photos of images on video screens in Popular Science readers'

homes. Those on this page were chosen as the best among more than 500 entered in the competition for cash prizes announced in August. Runners-up are on the next page.

All were taken at slow speeds with wide apertures and fast film. Some photographers tried high speeds and got pictures, but the judges held that these were better.



SECOND. Actress Nydia Westman on Dinner at Sardi's telecast from WOR-TV in New York. William G Baldwin, Carteret, N. J., used a 2" by 35" Busch Pressman camera, fast film, His exposure was 1/25 sec. at f/4.5.

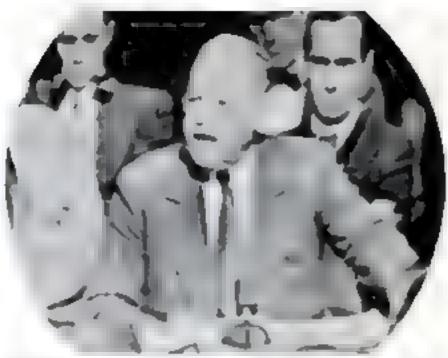


THIRD. Rise Stevens and Fred Allen on the Fred Allen Show from WNBT, New York. The photographer, John F. Ruppel, Jr. Malverne, N. Y. used a Ciroflex camera and made the exposure at 1/25 sec. at f/3.5 from a 10" tube.

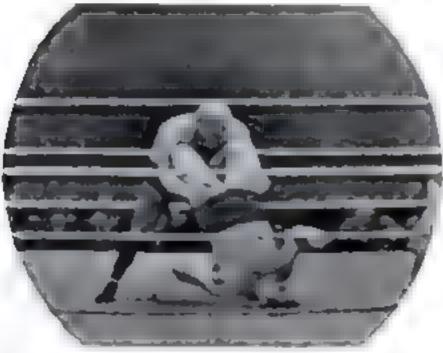
IRR POPULAR SCIENCE



History in the making. Russia's Jacob Malik, left, and Warren Austin, U.S. representative, at their deaks during the stormy August session of the United Nations Security Council, Donald Cohen, of Jamaica, N. Y., shot the two



photos from a WNBT telecast. He used a Bolsey B 35-mm, camera loaded with Plus X film. His exposures were 1/10 sec. at f/3.2. The film was first developed for 10 minutes in Ansco 17 developer and then reduced a bit.



Wrestling. This type of TV shot is one of the most difficult. George E. Brown, of Toledo, Ohio, took it during a local bout telecast by WSPD-TV, Toledo. He used a 4" by 5" Speed Graphic, exposing for 1/25 sec. at f/4.7.



Drama. Rita Colton and William Windom get together in Shakespeare's Richard III, WNBT, New York Michael Benvengo, Brooklyn, N. Y., put a portrait lens on his Argoflex and exposed at 1/10 sec. and f/4.5 on Super XX.



John Cameron Swayze extends season's greetings on a news program. Ross W. Garrett, of Lancaster, Pa., shot the photo from his local station, WGAL-TV. The exposure was 1/25 sec. at f/4.5 with a "23" Crown Graphic,



Singer. Fran Warren lets loose a high note on Toast of the Town, WCBS-TV, New York. Charles A. Ligibel, of Jersey City, N. J. made the exposure with a Recomar at 1/25 sec. and 1/4.5 on Super XX, film, Developed in D-76.

Simple Ways To Fix Toys

YOU and all the rest of Santa's helpers will be busy from now until Christmas Day, but don't forget to take time out for those old toys. You've probably noticed how a child sometimes forgets his new toys shortly after Christmas and returns to an old one. If you ask why, the usual answer is, "I just like it better."

Many old toys have lots of life left in them. A little work—sometimes only a new paint job—and they're back in the running with the new toys. A few quick and easy fixes are shown on these two pages.

Plastic toys. Most of these are molded from polystyrene, which can be cemented with its solvents, among them acetone and chloroform. Apply enough to soften the surface, squeeze together, and hold until solvent evaporates. A good cement for polystyrene is available from Koppers Company, Inc., New York, at \$1.20 a pint. Heat softens polystyrene and it can be "puddled" together with a soldering iron, a useful dodge if you have no cement. This also makes a quick fix where repair doesn't show, as for example where axle slots in toy cars have enlarged or spring enough to let the axle pull out. Use the soldering iron to push the hot, softened plastic together over the axle.

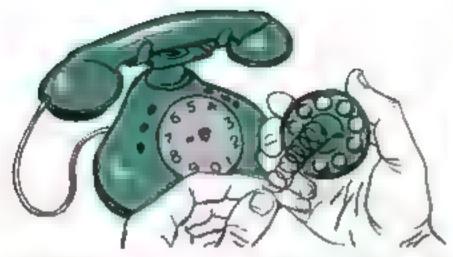
Flexible plastic toys can usually be repaired with acetone. Nun-only unil-polish remover may also serve if acetone isn't at hand. Apply the solvent freely to the break, place the surfaces together, and hold with rubber bands, clothespins, or paper clips until the acetone has fully evaporated.



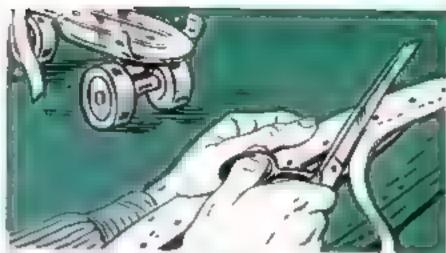
Cowboy hat. Dry-cleaning fluid will take out the spots. Iron brim under damp cloth, Wad up rags in crown and run iron over outside of crown. Add a bright new cord around the brim.



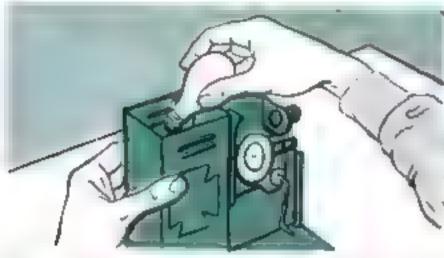
Holsters. Quick draws often tear leather at the rivets. Refuseen through undamaged material nearby, using split or tubular rivets with burs (washers) under the end you hammer.



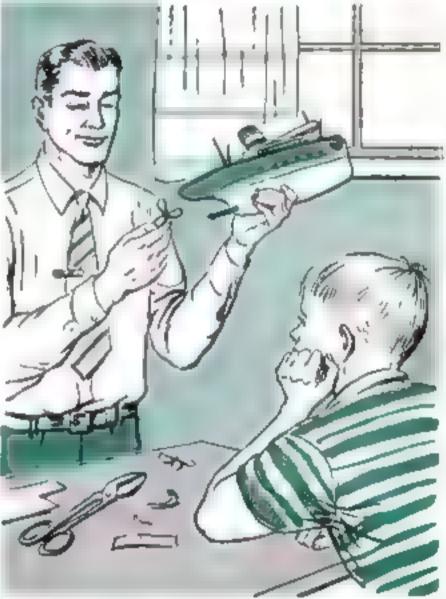
Telephone. Spring that returns dial often pulls loose. Spring is attached to underside of dial and to base of phone. Remove dial, drill hole, and hook broken end of spring through hole.



Roller skates. New wheels can be bought at a toy shop or hardware store. Cut new straps from an old belt. If clamps are lost, use straps. Give skates a good cleaning and oiling



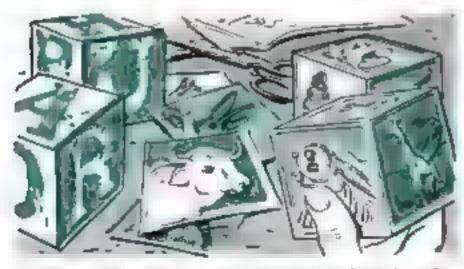
Movie projector. New spool brackets can be bent from coat-hanger wire, filed to fit body slots. Make certain the film gate works freely, and that electric cord and plug are okay.



Mechanical boat. Judicious straightening of a bent propeller shaft often gets these out of dry-dock. If prop is bent beyond repair, cut a new one from tin plate and solder it on.



Trucks and autos. Press out dents from inside, using a blunt stick and hammer on stubborn ones. Spool ends, jar lids, or wooden disks make fair substitutes for missing wheels.



Building blocks. Re-cover with colorful wallpaper scraps or chippings from picture books. Stick colored Scotch tape along all the edges to frame the picture and reinforce the blocks.



Doll. If eye mechanism is broken, remove wig and stuff head with cotton to hold eyes in open position. Retouch worn color with nail polish. Restring loose limbs with strong clastic.

How to Refinish Your Floors By Bernard Gladstone PROPER PROPERTY W. W. MORRIS

With machines you can rent, you can do a professional job. Here's the know-how.

AS LIVING costs rise, you're probably eager to cut as many corners as you can. I know I am. That's why I refinished my own floors. It was work, all right, but I saved about \$70—and the three floors that I redid look like new.

I shopped around among several floor refinishers and got estimates ranging from \$80 to \$90 for the floors I wanted redone. But I found I could do all three rooms myself for about \$20 if I rented two sanding machines and a buffer.

These machines are rented by the day, You can sand three average-size rooms in one day. So it's cheaper to do three rooms at a time than to prolong the job by doing each room on a different day.

Here's what you'll need:

Drum-type floor sander,

- Disk-type floor sander, called an edger,
- Hand scraper,
- Buffer.

 Finishing materials (see the data card on page 173).

Strip the room clean of hangings, pictures, and blinds as well as all furniture. The sander will leave a coat of dust that settles over everything in sight, so the more furnishings you remove, the less cleaning you will have to do afterwards. If your home is heated by radiators standing out in the rooms, disconnect them so they can be moved around if necessary.

Preparing the floor. Go over the whole floor and check for loose, squeaky boards and protruding nail heads. Use a hammer and nail set to sink exposed nail heads. Then fill the holes with composition wood.

Squeaks in a floor usually are caused by loose boards. If you find that the floor boards





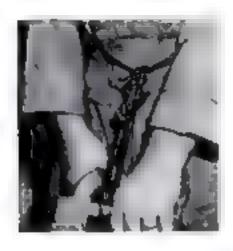
Above: Driving a 2" finishing nail at an angle of 45° into a squeaky board anchors it to an adjoining board, silencing it.

Left: To avoid marring the floor with hammer, a neal set is used to punch head below surface instead of driving it all the way in.

Below: Loose subflooring must be nailed to a joist. Drilling from cellur marks joist. Nail can then be driven through floor to it.





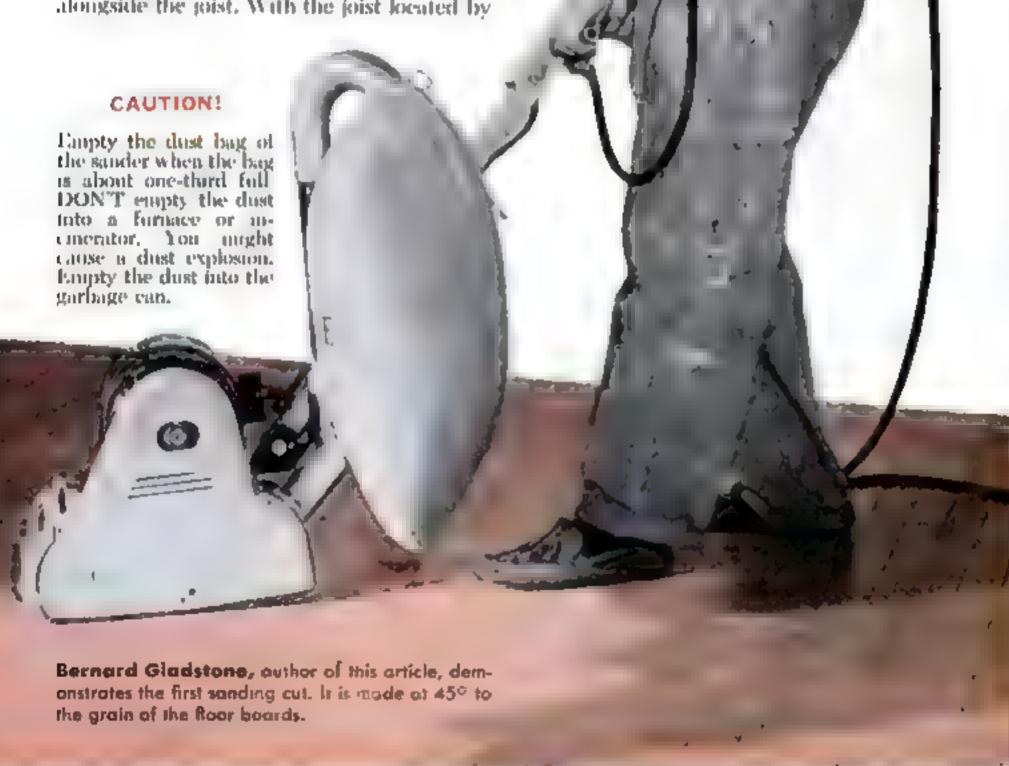


Here's a trick (left) that will take some strain of sanding off your back. Wrap a rope or wire around your waist and loop it over handle of the sander

are tight—but there's still a squeak—then it may be the subflooring that's loose. But if only one board moves down as you put your weight on it, the chances are that it's a floor board that's squeaking. Drive finishing nails through the board at a sharp angle.

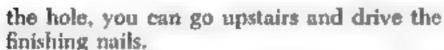
If the squeak is caused by loose subflooring, you'll have to drive 3" or 4" finishing mails through the floor, subflooring, and into a joist.

If you're working on the ground floor, go down to the basement and have someone step up and down on the squeaky spot. You'll hear it and be able to locate the nearest joist. Use a very fine drill and make a hole up through the subflooring and floor alongside the joist. With the joist located by





On floors that have extremely uneven boards, you may have to make first cut at 90° to the boards to get the old finish out of valleys.

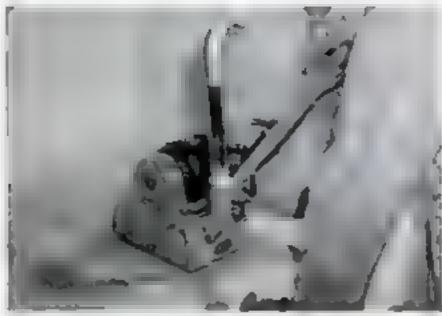


When the joists are concealed by a ceiling, you can locate them by tapping the ceiling lightly with a mallet. You'll get a solid rather than a hollow sound when you're tapping below a joist. Joists are normally set 16" on centers. After you locate one by tapping on the ceiling, measure from the wall to the joist. Then go upstairs and repeat the measurement on the floor.

Sanding. The drum sander is the larger of the two sanders. It will do the bulk of the sanding. But it can only go within two or three inches of the baseboard. The edger is used to sand the rest. In corners—where even the edger can't reach—you'll have to use a scraper and sandpaper.

The man you rent the machines from will show you how to operate them and how to change sandpaper.

Go over old floors with three different grades of sandpaper—4-16, 2%-30, and %-60 in that order. Use the same grades of paper



Final sanding with each of three grades of paper should be done with the grain. Keep sander moving. Don't stop it with drum on floor

in both the drum sander and the edger. If you are sanding new, unfinished wood, skip the sanding with 4-16 paper.

Always start the machine with the drum off the floor. Move slowly forward as you lower the drum to contact the floor. Continue walking slowly forward. As you approach the end of the forward cut, raise the drum from the floor before the machine comes to a stop. Then start the backward cut by walking backwards, making sure the machine is in motion before the drum touches the floor.

Don't place weights on the sander or lift up on the handle to increase pressure of the drum on the floor. The drum load of the machine has been set at the factory to exert just the right pressure.

Generally speaking, all sanding should be done backward and forward with the grain. But, to eliminate unevenness in the floor boards, the first cut is sometimes made at a 45 degree angle to the grain.

After rough sanding (4-16 paper) the



Since drum sander won't reach right up to baseboards, an edger (left) is used to remove the final two or three inches of old finish near the walls. Even the edger—a disk sander—won't reach into all corners. A scraper (center) is

needed for this job. After taking off as much of the previous finish as you can with the scraper, wrap a piece of sandpaper around a block of wood (right) and smooth out the corners to match the rest of the floor.

whole floor, finish up with the edger, using the same grade of paper. Then go back to the drum sander and make your second cut with the grain, using 2%-30 paper. Follow with the edger. The final cut with both drum sander and edger is made with %-60 paper.

When you've finished sanding, take off your shoes before walking on the raw wood. Your shoes might leave dirty foot marks on the floor.

Clean up. Before starting the finishing operation, get all the dust out of the room. The easiest way to do this is with your vacuum cleaner. Then go over the woodwork with a damp cloth to get any dust the cleaner may have missed. Don't forget the tops of doors and door and window frames. Any dust left in the room may be disturbed during the finishing and settle on the still-wet finish.

Finishing. Three finishes that are frequently used are described on the data card below.

You don't need to use a filter with floor seal. But for a smooth shellac or varnish finish on open-grain hardwoods—such as oak—you should use a paste-wood filter. Thin the filter to brushing consistency with turpentine. Brush it on across the grain, working only a small area at a time because it dries quickly—in about 10 minutes. Watch it carefully and as soon as it begins to dry or get dull, wipe off the excess. Wipe across the grain with a piece of clean burlap. Then let the floor dry for at least 12 hours.

Next rub the floor with No. 0 steel wool.



Finishing touch for your refinished floors is waxing. Renting a buffer will save you time and work, and is well worth the money.

working with the grain. An easy way to do this is to tie the steel wool to a push broom. Sweep up all dust and grit left by the steelwool rubbing.

If you want your floors darker, stain them after using the filler. Or, you can save time by mixing a little color in oil with the filler. There are several ways, in fact, to darken the finish: For a darker shellac finish, use orange shellac instead of white shellac; for a darker varnish finish, use a colored varnish stain for the first coat; for a darker floor seal finish, use a colored seal.

| TYPE | CHARACTERISTIC | | HOW TO APPLY | | |
|------------|--|---|---|--|--|
| FINISH | ADVANTAGES | DISADVANTAGES | Tet Coet | 2nd Cost | Sed Coat |
| Sholler | Orms 'quickly in from 1 to 2 hours. Does not durken wood, | Very brittle Water causes if to turn white. Scratches equity | 5-lb. cut shelloc thraned 3 parts shelloc to 1 part denotioned alcohol. Let dry 2 hours. | 5 lb cut shel- loc, thinned 4 ports she loc to 1 port de- natured olco- hol Let dry 4 hours. | Posts was rubbed in west, and buffed when dry |
| Varuish | Film is tough yet flexible. High scrotch resist- once. Does not storn or water- spot easily | Slower drying. Room cannot be used for over 36 hours Tends to dorken wood, | Finer Varialsh thinned & ports variash to 1 port turpentine Allow to dry about 12 hours. | floor wornish straight from can. A low to dry about 24 hours. | Poste wo: subbed in well, one buffed when dry |
| Floor Seel | Does not require falter. Fenna-trates into pores of wood, high scratch resistance. Water-proof, | Takes more work on much coul must have ser plus rubbed off. Slower drying than shellor. | Struck on full strength. Allow to penetrate for 15 or 20 minutes, then wipe off extens with clean map or burlop reg | Some as first coot. Allow 6 hours between coots. | Paste was rubbed in well, one builfied when dry Dry 8 hrs. before waxing. |



Gus Fixes the Local Scrooge

The veteran Model Garage owner loosens up a tightwad—and helps a good cause as well.

Martin Bunn

US WILSON was sitting on a stool in front of his bench in the Model Garage repair shop reading a letter and munching one of his lunchtime sandwiches.

"You Gus Wilson?"

It was a harsh, rasping voice, and Gus looked up to find its owner to be a large, bulky man who seemed even bulkier than he was because of the fur-collared storm coat he was wearing.

"That's right," Gus answered, putting the letter and his sandwich on the bench and slipping down

off his perch.

"Supposed to be quite a man with automobiles, aren't you?"

the big man boomed sarcastically.

"I'm a mechanic," Gus replied. "Why, the way I hear it, you've never been stumped by anything

that runs on gasoline," the bulky

man boomed.

At that point, Gus had an overwhelming desire to answer sarcasm with sarcasm, but before he could speak his visitor went on, "My name's Purcell, William J. Purcell of Evansville."

Gus knew the name only toe well, but he was blamed if he was going to acknowledge it. William Purcell was the wealthy owner of a lumber mill just outside Evansville, about an hour from our town. He was a sharp trader who'd made millions in one way or another and who'd never been known to spend any of it on anyone but himself. He held the unenviable position of being one of the most disliked men in our corner of the state.

A Big-Mouthed Big Shot

"You've surely heard of me," the big man boasted. "I own the biggest darned lumber mill in these parts-built it up from nothing.

"Something we can do for you?" Gus interrupted coolly, wiping his

hands on a scrap of waste.

"Of course, of course," Purcell blustered. "I don't drive a hundred miles just to pass the time of day in a crossroads service station. Something's wrong with my car and I want you to fix it. But I warn you, no guesswork. I've already been taken by most mechanics in Evansville and I don't intend to start supporting one in this town."

"What's wrong with it?" Gus

asked

"What's wrong with it?" Purcell "Why ask me, man? repeated. That's just what I've come to you

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for. All I want to know is, can you fix it?"
"Well, Mr. Bucell." Gus answered, deliberately mispronouncing the name, "we
can't very well fix it if we don't know what's
ailing it! Where is the car?"

"Purcell, it's P-U-R-C-E-L-L," the big man spelled out. "The car's outside, and if we're lucky we may be able to get it inside."

At that moment, Stan Hicks, Gus's third arm, who had just come back from his lunch, started busying himself around the shop.

"Stan," Gus called, "will you go out front and drive Mr. Rochell's car into the shop

so we can have a look at it?"

"The name's PURCELL," the big man exploded. "Confound it man, if you can't remember a name for a minute how the devil can you fix cars?"

Gus ignored the blast.

"Now, Mr. Purcell," he said when Stan had maneuvered the car into the center of the shop, "let's get down to symptoms and maybe we can put our finger on the ailment. What's wrong with it?"

It's Cold-Start Trouble

"Blamed thing won't start," Purcell explained, and then added, "that is, it won't start with the starter after it's been standing two or three hours. If the motor's warm, she'll tick right off when you push the starter button, but if she's cooled down she won't start unless I get someone to push me for a block or so. Once she does start, though, she runs fine. No trouble on the road, but park her for a couple of hours and you're in trouble."

"You've tried to have it fixed?"

The big man's face reddened. "Take a look at these," he grumbled as he pulled a sheaf of dog-eared bills from the pocket of his big coat and shoved them at Gus.

Although Gus is always a stickler for good workmanship and honesty, he had to chuckle inwardly as he nilled through the

stack of bills. The mechanics in Evansville not only had tried just about everything, but had charged Purcell fancy prices to boot. The slips showed that the car now supposedly had a new condenser, a new coil, a new set of points, new plugs, a new distributor cap, a new battery, a new fuel pump, and a rebuilt starter motor.

"Well, can you fix it?" Purcell bellowed

as Gus studied the bills.

Gus Asks Some Questions

"Maybe," Gus replied bluntly. "Tell me, how does the motor act after it's been standing idle for a few hours and you try to

start it? Does it pop or backfire?"

"Doesn't do a damed thing. Just acts deader'n a door nail, and I can turn her over till the battery's dead and still nothing happens. But if I can get someone to push me, she'll generally take hold and purr along."

"Well, I won't promise any miracles," Gus said finally, "but if you want to leave

it here we'll do our best."

"Fine," Purcell agreed, "but mind you, no fancy prices. I've a deal on here in town today so I can give you until five-thirty. If you haven't found the trouble by then, I'll pay you for your time. If you have found it, and fixed it, I'll pay you what you ask plus a bonus." With that, before Gus could reply, he stomped out of the shop.

"And who's that stuffed shirt?" Stan asked as the shop door slammed. "He acts like

he owns half the county."

"That, Stan, is Purcell, William J. Purcell of Evansville," Gus mimicked, "and in the eyes of some people—particularly Purcell's—he does own half the county. What he hasn't made in the lumber business, he's made on mortgages. Well, enough grousing. Let's get at this fancy car of his. We've only got a few hours."

Others Had Tried and Failed

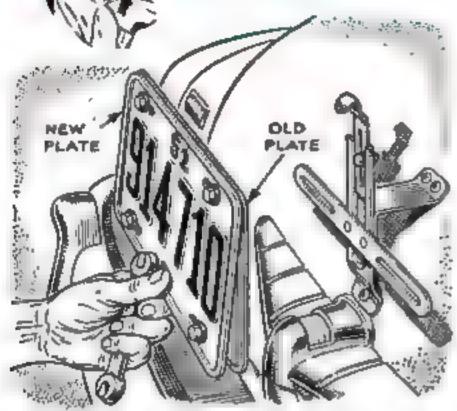
In checking over the bills again, Gus realized that most of the obvious possible causes for the trouble already had been taken care of without much in the way of results.

"Any ideas?" Stan asked as Gus dropped the bills on the bench next to his half-eaten sandwich and the letter he'd been reading when Purcell had come in.

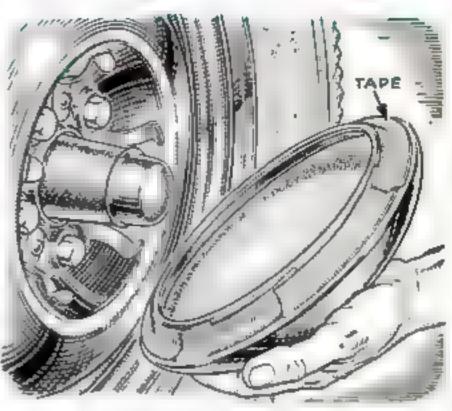
"One thing's for sure. The mechanics in Evansville seem to have taken care of

[Continued on page 226]

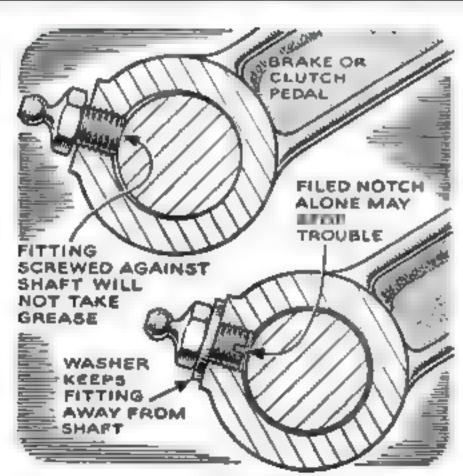
Hints from the Model Garage



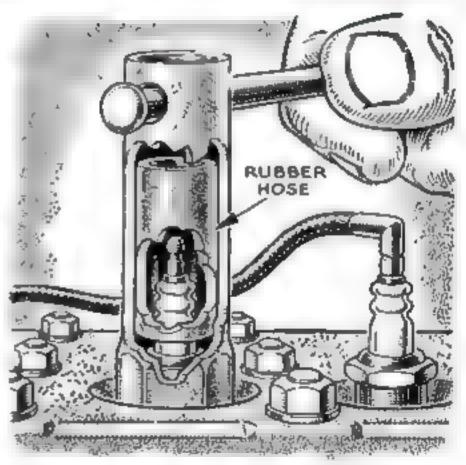
Old Plate Reinforces New One. Some states economize by making their automobile license plates out of thin-gauge metal. You can reinforce these—or any other plates—by reversing your old ones on the bracket behind your new plates.



Tape Protects Wheel Paint. The outer rim of a hub cap sometimes wears paint off the wheel, leaving a rusty ring. J. C. Branstetter, of San Francisco, has found that this can be avoided by placing strips of masking tape around the rim,



Refitting a Grease Fitting. If a grease fitting won't take grease, it may be that the end bears against the shaft, keeping the grease from getting through. Try a new fitting first. If that doesn't work, you can do one of two things—file a notch in the end of the fitting or use a washer as a spacer to hold it away from the shaft.

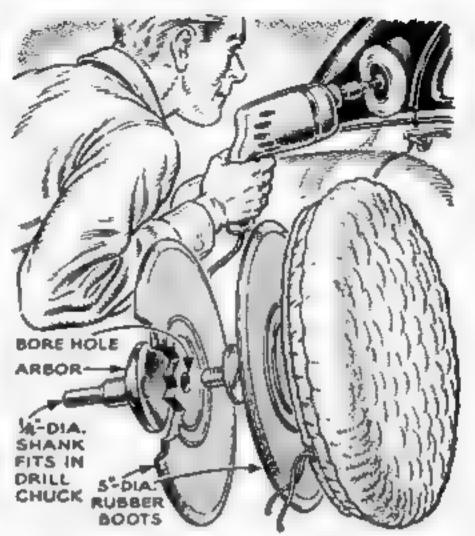


Hose Protects Spark Plug. When you are removing or replacing a spark plug, the porcelain may be cracked if the wrench slips to a cocked position while you are exerting pressure. To prevent this, Manon L. Rhodes, of Knightstown, Ind., suggests slipping a short piece of rubber inside the wrench to act as a cushion.

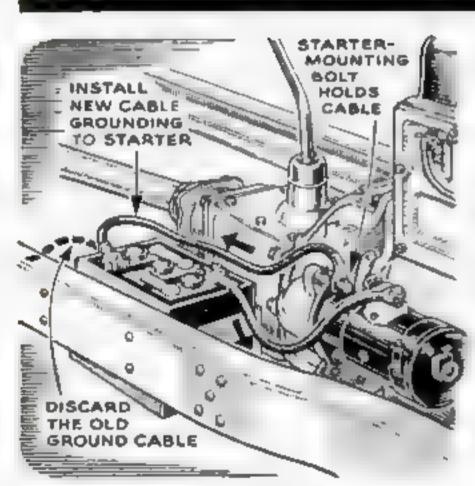
MORE Hints from the Model Garage



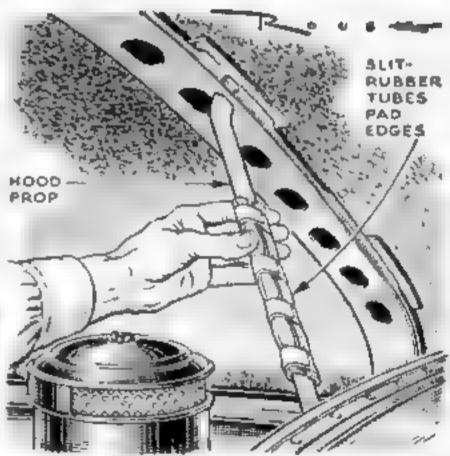
Can Makes Valved Funnel. Cut the bottom from one of the containers in which whipped cream is now sold and you've got a handy funnel for filling a battery. Before cutting, make sure can is empty. Pressure on the stem opens the valve.



Tire Boots Pad Buffer. Two tire boots make excellent backing for a buffing bonnet. Use the round kind that are reinforced at the center. Run the screw through only one. The other will then prevent scratches if the bonnet wears through,



For Easier Starting. Your engine may start a lot quicker, especially in winter, if you transfer the battery ground lead from the chassis to the starting motor. With the battery grounded to the chassis, a rather high voltage drop sometimes occurs. The trick will work on both positive- and negative-grounded batteries.



Pad the Hood Prop. The swinging bar that's used in many automobiles to keep up the bood will be easier on your hands if you pad it with a strip of rubber tubing. Slit a length of tubing, slip it over the edge of the bar, and wrap adhesive or friction tape at intervals to keep the tubing in place. You'll find it handy in cold weather.

A plastic showcase displays the 1949 Mercury engine installed in this 1929 Ford roadster.

See-Through Hood Shows Off Engine



MAKING a plastic hood is a cinch," says Ken Fuhrman, of Berkeley, Calif. "Anyone can do it who has a shred of mechanical ability and an engine he wants to show."

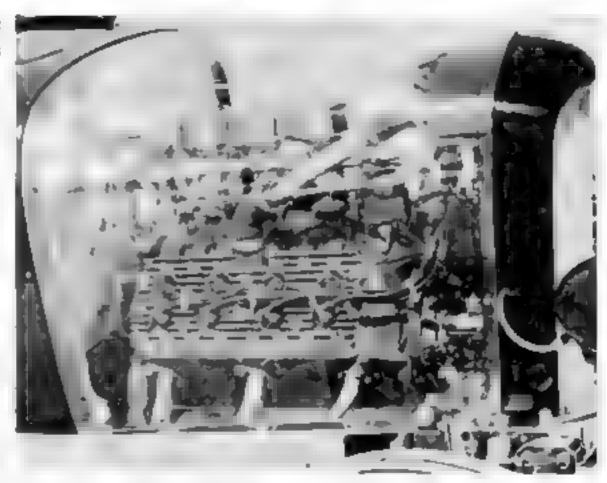
As proof, Fuhrman presents his own roadster, a trim speedster judged "most beautiful" in several shows. Kept sparkling, the plastic hood speaks for itself.

The flat sides were cut to size from sheets of clear plastic. Forming the curved top was more tricky—but easier than it looks. As the first step, a wood and sheet-metal form was assembled. The form and a sheet of plastic were then put into an oven preheated to 225-250° F. After the plastic had draped itself over the form, both were removed from the oven and the plastic

Finding an oven big enough for the job caused some trouble. If you'd like to make such a hood, Fuhrman suggests that you find a plastic shop or a paint shop that specializes in baked-enamel finishes.

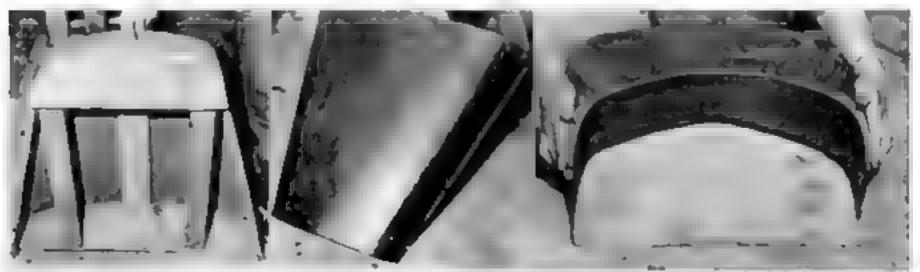
"wiped" onto the form with a soft cloth.

The curved piece was made oversize to permit tramming to fit. A keyhole saw, with



Curved top lifts off when the metal trunk latches are unhooked. This permits the engine to be serviced without removing the flat hood sides. These are screwed in place.

plenty of set in the teeth, was used to trim off wide sections. Final delicate trimming was done with a coarse mill file. To prevent shattering, these operations were carried out with the plastic pressed against a solid surface. Only forward strokes of the cutting tools were used. Reinforcing strips of plastic were cemented around the edges of the hood.



A form for bending top part of plastic bood was made from wood and sheet metal. Wood ends of form were cut to match the curves of

cowl and radiator shell. The sheet metal was then bent and tacked to the wood. When heated, the plastic bent around the form as shown above.

You Can Make Rubber

With a 30-cent kit, you can perform simple home experiments that duplicate the magic of the chemists.



By Kenneth M. Swezey

YOUR tires, the radiator hose, and countless other parts of your auto contain milk-like latex—which came either from an East Indian rubber tree or a synthetic-rub-

ber factory.



For 30 cents, the U.S. Rubber Co., New York 20. N.Y., will now send you a sample of synthetic latex in a kit that also contains bits of natural and synthetic raw rubber, vulcanized tire rubber, sheeting, thread, and foam rub-

ber. And with this kit, anyone can duplicate the magic of the rubber chemists.

Latex consists of a finely divided suspension of solid particles in water. Dilute when originally produced, it is usually concentrated by "creaming." You can cream the latex from your kit by putting three table-spoonfuls in a tumbler and slowly stirring in a tablespoonful of a saturated solution of common salt. The latex will thicken and, if left to stand, will rise to the top like cream on milk.

To make a sample of rubber, slowly stir the creamed latex, and add a table-spoonful of vinegar solution (1 tbs. vinegar to 3 tbs. water). As you do this, the latex will change into a lump of rubber.

Rac rubber is made commercially in exactly the same way—by adding brine and acetic acid to latex. After being washed and dried, the coagulated rubber is pressed into sheets for further processing.

Squeeze your homemade rubber into a tight ball, and it will bounce. When it has dried, you can also rub out pencil marks with it. Joseph Priestley discovered this property in 1770 and immediately changed the mouth-filling East Indian word "caoutchoue" to "rubber," the term that has stuck ever since.

Rubber cement is made by dissolving raw rubber in a solvent such as benzol,

gasoline, or benzine. You can make a usable sample by breaking your ball into bits and dissolving these in any of the solvents mentioned. (Lighter fluid, which is usually benzine, will do a good job.) Add the solvent slowly, until the particles have

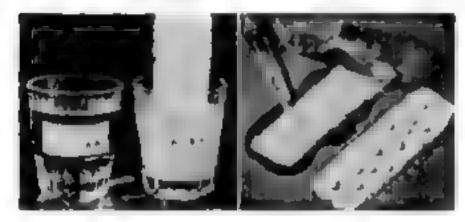


completely dissolved and the resulting cement is of the right consistency. To prove its strength, cement two sheets of paper together.

Waterproof textiles and yarns are often produced by coagulating latex right in the material. To demonstrate how this is done, put some latex in one small glass and



a solution of 1 part vinegar to 3 parts water in another. Soak a strip of clean cotton cloth in the vinegar, dry off the surplus solution, and then dip the cloth in the latex. A layer

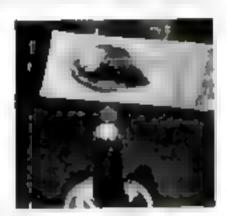


of rubber (that becomes thicker the longer it is immersed) will be precipitated on each side of the strip. Once the strip is dry, water will roll off the strip as it does off a raincoat, instead of soaking right through it.

Nearly everything we think of as rubber is really a compound of many ingredients that has been vulcanized—treated with heat. The added ingredients, plus heat, make rubber compounds hard or soft, add toughness, and control the color. The effects

of vulcanization are easily demonstrated.

One difference between raw and vulcanized rubber is the comparative resistance to heat. Put a square of smoked sheet on a strip of tin. When the



tin is heated, as shown in photo above, the rubber will melt and begin to decompose

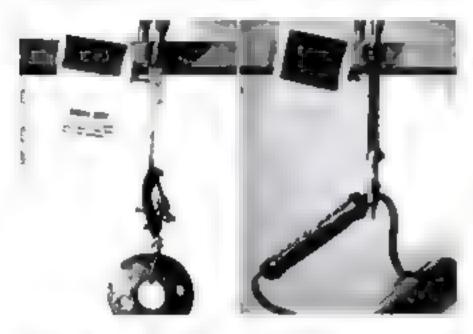


From crude to cured rubber. Many ingredients go into common rubber products. This photographic chart shows typical chemicals

needed to change "smoked sheet" from the plantation into rubber suitable for tough tire treads. The heating step is called vulcanizing.

amid smoke. A square of cured rubber, heated to the same temperature, merely curls slightly.

Another difference can be shown by cut-



ting strips of the same dimension from samples in your kit. Clamp one end of each strip to the edge of a table or board and hang a weight from the other. Smoked sheet begins to weaken and tear under a pull of only eight ounces. Cured rubber supports an eight-pound flatiron easily.

Foam rubber is made by adding sul-

fur and other ingredients to concentrated latex and beating air into it in a giant mixer. The fluffy mixture is then poured into molds and vulcanized. This method produces a cell structure that is intercon-



nected. You can demonstrate this structure by blowing out a candle through the foamrubber sample that comes with your kit.

Why tires heat up when speeding over the road can be shown by stretching a rub-

ber strip and quickly touching it to your lips. The strip will feel warm. Release it suddenly, and it will feel cool, Rubber heats up when stretched be-



cause tension strains its molecules. It gives up its heat when the strain is released. Driving stretches tires, building up heat faster than it can be dissipated.

These Miniature Merry-Go-Rounds Run Throughout the Winter



AFTER running a merry-go-round for five years, Charles Hutchens, of Bell Gardens, Calif., built one of his own. The little model shown above measures three feet in diameter, is 21 inches high. Dime-store cowboys and Indians chase each other as the machine goes 'round and 'round. An electric motor turns the carrousel at 12% r.p.m.



An old wind-up phonograph can keep the kids amused with more than music. Here one is being used to spin a miniature merry-go-round. Carl G. Erich, of Abilenc. Kans., built the carrousel and hand-carved the horses and chariots. The animals rise and dip as they whirl around. Christmastree lights circle the dome.

Your Tires Will Last



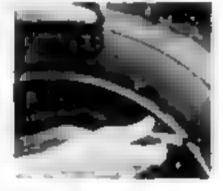
you consider the weather. Keeping them at the right pressure is more difficult in winter because of the changes in temperature which they undergo when you move from warm garages to cold streets.

An increase or decrease of 8.5° in temperature can change tire pressure one pound. Hence, if you should check them in a garage where the temperature is 70°, then drive out into subzero weather, they would be seriously underinflated.

How seriously? Figure it out: 70 divided by 8.5 is about 8. Tires inflated to 24 lb. would lose 8 lb., and be underinflated 33%

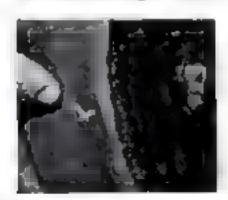
percent in this case.

you check them often. It's a good idea to do it once a week, and to use the same gauge each time because gauges at different garages may vary considerably. Do



your checking only after the tires have cooled to atmospheric temperature. And be careful not to lose the valve caps; they help prevent air loss if a valve happens to leak slightly.

factory usually puts a mark on the sidewall near the bead, denoting the light point of the easing. Since the valve stem is the

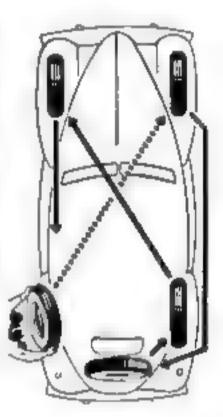


heavy point of the tube, it should always be placed opposite this mark. An out-of-balance tire wears more rapidly. If necessary, have the wheels balanced.



your car is okay. Improper caster, camber, and toe-in all leave their own individual marks on the front tires. Keep tabs on your tires for such signs and have the front wheel alignment checked at intervals. Also keep brakes evenly adjusted, or one tire will leave a thin trail of rubber every time you stop fast.

you rotate them 3,000- or 4,000-mile intervals. To avoid having more than one wheel jacked up at a time, put on the spare first. Follow through shown. Inspect tires frequently, too, for cuts and bits of glass or tacks embedded in the rubber. Whenever they're smeared with oil or grease, wipe it off.



scrape the curb, for this damages the casing. A pair of curb feelers will help prevent such damage. In diagonal parking, nose into curb slowly. Turn corners at moderate speeds so the tires won't slide on the pavement, and remember that fast starts and sudden stops wear out rubber.



Homemade Hunting Knife Saws and Cuts

HERE's an all-around hunting knife that you can make from an old power hacksaw blade. Besides the razor-sharp cutting edge, the opposite edge has teeth that will saw through bones, saw a crotched limb for your fishing pole rest, or scale fish. The notch will open bottles.

Construction is simple and it's not necessary to remove the temper from the saw blade to make handle fastenings. Cut off the end of an old hacksaw blade to make your knife blade. The teeth at the end of a hacksaw blade usually are in pretty good condition since they don't get much use.

I shaped the blade on a cutoff wheel, making it 6" long with a shank %" wide and 2%" long. When you sharpen the back of the blade, you can get a factory-like edge by using a simple sliding jig to pass the edge across the grinding wheel. However, you can grind it freehand if you're careful.

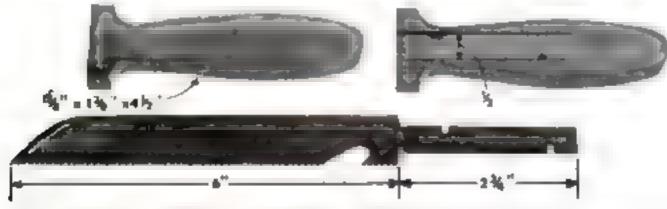
In making the handle, use two %" by 1%" by 4%" hardwood blocks. Cut the bland groove in one block just deep enough to take the shank of the blade. After grinding two small notches in the shank, lay the shank in the slot and drive a nail into each notch and into the grooved part of the handle. Snip off the nail heads as close to the shank as possible. This will leave the nails extending about %" above the surface of the grooved half of the handle.

Place the shank in the groove, apply



One edge of this hunting knife still has the teeth of the power hacksaw blade from which it was made. Other edge has been sharpened.

waterproof glue to both halves of the handle, and clamp them together until the glue sets. Then you're ready to shape the handle to a comfortable grip with rasp and sandpaper.—W. G. Waggoner, Sacramento, Calif.



Only critical dimension is groove in one half of handle. It must be exactly deep enough and exactly wide enough for shank of blade Otherwise, blade will wobble in handle.

Jig Guides Bit to Insure Perfect Alignment of Dowel Holes



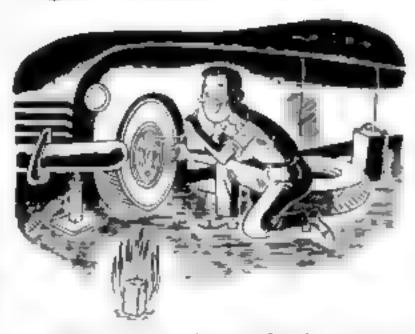
You can bore dowel holes square and dead center on the thickness of the work when you use the jig at left. The screw has right-hand threads on one end and left-hand threads on the other end. When you turn the handle clockwise, the jaws are drawn together to exert equal pressure and center the middle member, with the bit guides, on the work. The jig takes five bit sizes: X", \[\frac{1}{16}\]", \[\frac{3}{16}\]", \[\frac{

POPULAR SCIENCE



OLD photoflash bulbs are the makings of these unusual tree ornaments. With pliers, break free the center contact, pull it out, and insert an ornament hanger. Soak the plastic coating off the glass with acetone, coat with paint, and sprinkle with silver or gold flakes (called flitters and available at hobby shops). Glue on paper hats and cotton beards to make the little faces. Bits of colored tape form the features.

My Most Ongenious Solution

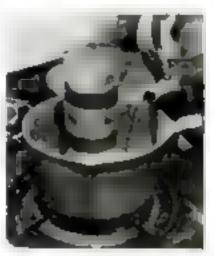


While driving along a lonely country road one night, I was stuck with a flat and no light to work by while I changed tires. But while stumbling around in the darkness I stumbled over something that made an excellent emergency light. What do you think it was?

The thing I tripped over was an old clay brick. I syphoned gasoline from the tank, soaked the brick in the gas and lighted it. The brick absorbed enough gas to keep burning until I changed the tire.—Harry E. Vendryes, Jr., Jamaica, B.W.J.

Simple Way to Unstick Glasses

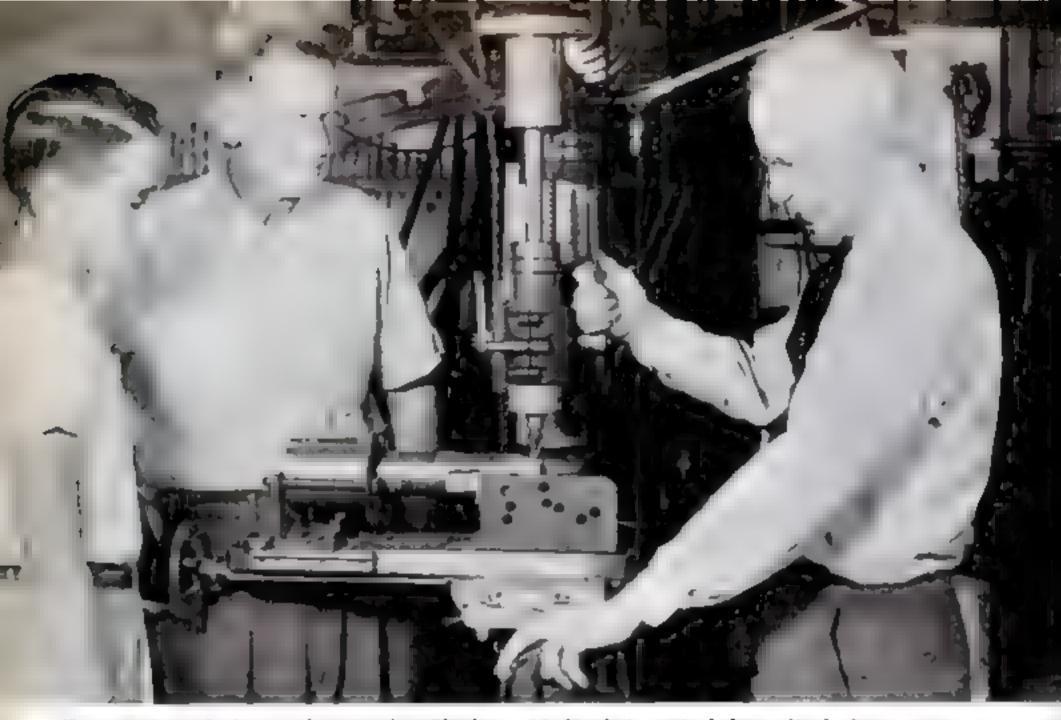
When two glasses or bowls stick together, put a few ice cubes in the top one and set the bottom one in hot water. Let them stand a few minutes and they'll come apart easily. — M. McLeer, Moose Jaw, Sask.



A Wet Sock Snares Radiator Dust

DRAW a wet sock over the bristles of a radiator brush before use. It will clean between the pipes more effectively and won't cause the dust to fly about as dry brushing will.—R. M. Woodbury, Haverhill, Mass.





Teamwork paid off in production when Charles A. Trask, a retired engineer, began doing defense work in his basement shop in 1942. Soon swamped with jobs, he recruited neighbors and high-school boys, training them himself. Now

83, Trask is again helping Uncle Sam re-arm. Here he shows two friends in his shop how to work a small vertical milling machine. That thing he's making is an adapter sleeve for a 30-ton borizontal boring mill.

Can You Help America Arm?

Home shops can turn out thousands of items that Uncle Sam needs right now. By Ray Miliholland

Formerly Chief of Technical Unit, War Production Board

AMERICAN industry can re-arm our country and our allies faster and more economically if every suitable tool is put to work. There are many such tools in home workshops. They helped to win World War II, and they can help again now.

A production-wise Yankee mechanic, for example, refused to sit out the war against Germany and Japan in his rocking chair and converted his back-yard shed in New England into a precision shop for making machine-gun bullet dies. This is one of the

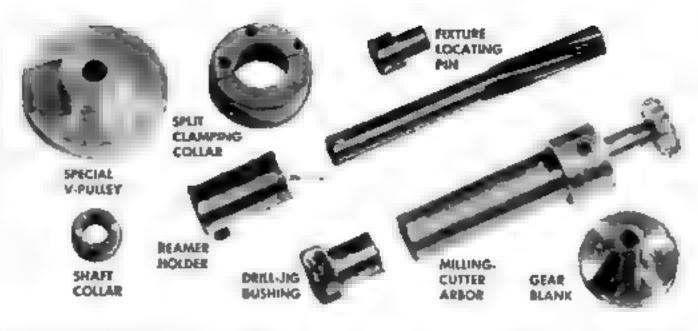
toughest production problems for the big shops, but this veteran of the lathe and bench proceeded to take the headache out of making bullet dies. He originated a method that he taught to unskilled men in a few hours.

Where to Find Work

That's just a sample of what can be done. Literally thousands of the items needed now can be made in a home workshop equipped only with a screw-cutting bench lathe. Tooland-die shops searching in vain for highly skilled toolmakers have many rough-turning jobs that can be done very well by amateurs, thus saving the more skilled men for the final, precision-finishing operations.

Characteristic of these rough-turning jobs

Any of these parts can be turned out on the sort of bench lathe found in many home shops. A drill press is a handy auxiliary for drilling and tapping the various holes.



are plug-gauge blanks, drill bushings and liners, special screws, handles, locating pins, special lathe-arbor blanks, special reamer and round broach blanks, and ring-gauge blanks. Roughing out these vital items requires more time than the final precision sizing, and many harassed tool-and-die-shop owners will welcome a workshopper's help.

The production shops that are working directly on defense jobs, either as contractors or subcontractors, frequently have rough-turning tool jobs coming up. These shops will also need small replacement parts for their machine tools. A cam roller will wear out, a special screw break, or a bronze bearing fail, and have to be replaced at the earliest possible moment.

Small repair parts—mostly lathe jobs—would have to be made in the production plant's toolroom. So you may make a friend for life by letting the toolroom foreman know you have a sturdy little screw-cutting bench lathe in your basement and are available evenings for "emergency operations."

Home-workshop operators who do not live in industrial areas can do other kinds of emergency work. Farmers are likely to need repair parts for their machinery. Refrigerator units and domestic appliances sometimes need a new bushing—in a burry. Men who ordinarily do their own work may be working overtime elsewhere. And in a few minutes on a lathe a standard part for one kind of equipment often can be altered to keep some other kind of equipment running.

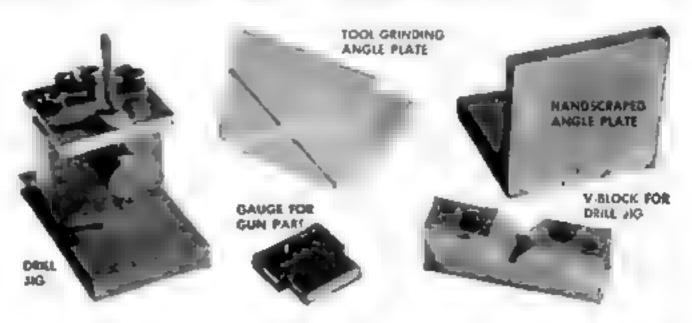
How Organisation Counts

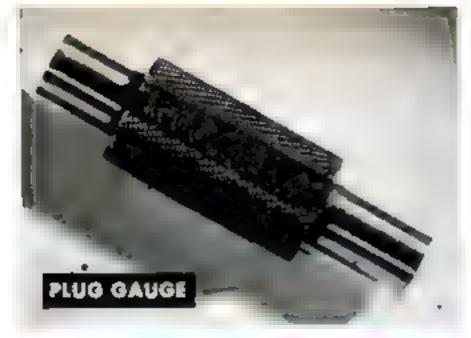
Pooling facilities as well as manpower multiplies the effectiveness of the small shop. One member of the pool may be able to contribute, besides his time, a more suitable workplace than his associates. The others then can move their readily portable lathes, drill presses, bench nulling machines, small shapers, and power hacksaws into his shop. All hands contribute odd bits of material, drills, taps, reamers, micrometers, and other small tools to the pool—and in a matter of hours a small but well-equipped machine shop has sprung up!

snop has sprung up:

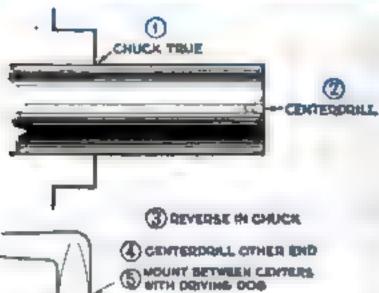
In the 1940's a retired mechanical engineer, who converted his basement shop into a very effective defense production unit, soon found that one man could not keep a pair of screw-cutting lathes, a small milling machine, and a 7-inch shaper working to capacity So he scoured the neighborhood for help and found several elderly, retired men who were more than anxious to do their part. He also enlisted some husky high-school boys. The retired engineer supplied the know-how—and by the end of the war his little basement machine shop was an important auxiliary source of supply for the

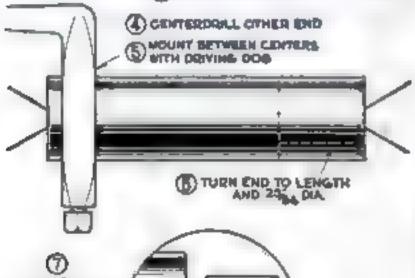
The drill jig and handscraped angle plate at right were produced by basement shops mentioned in this article. The other pieces are typical milling-machine or shaper jobs.

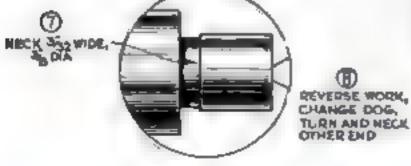














WHIRL WITH SPECIFIED ROLLS AND OIL ON WORK,

Thousands of small plug gauges are needed in mass production. Their working life is short and they must be replaced. Here's how they might be rough-turned in a home shop, ready for a toolmaker to grind to size and heat-treat.

toolrooms of more than a dozen large plants.

Nearly every man who is seriously interested, to the extent of putting his hardearned money into a small metal-working lathe, already has mastered the fundamentals of its operation. From there on it is a question of developing accuracy—and speed.

Accuracy Is a Must

Even the "rough-out" jobs that the home workshop machinist produces must be made to reasonably close dimensions. He must turn out a piece with enough stock left on the "close" dimensions so that the highly skilled toolmaker, who takes over from there, can finish it quickly. The customer usually specifies on his blueprint or sketch how much "finishing stock" to leave on.

Holes are usually bored five to twenty-five thousandths of an inch undersize, to allow for final grinding or reaming. Usually, tool shops like to have the rough-turned diameters run from twenty to thirty thousandths oversize. If the individual customer wants more or less stock left on a specific job, he will issue specific instructions on that point. The same applies to the over-all length of the piece and the distance from the end to the various shoulders on, say, a multiplediameter rough-turned shaft.

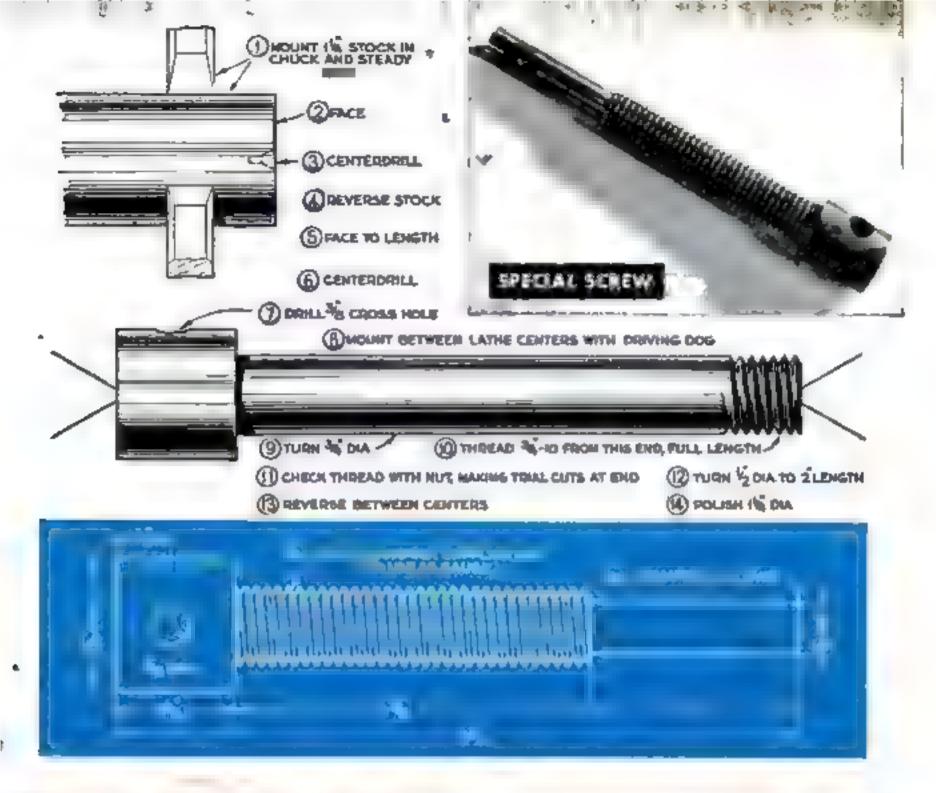
On these "roughing-out" operations finish is unimportant; so don't spend any time filing and polishing a surface that the toolmaker is going to remove later. A set of from one- to three-inch micrometers is valuable for doing even roughing-out operations, but an acceptable job can be done with only inside and outside calipers, a first-quality machinist's steel scale, and a magnifying glass.

Leave Enough Stock

There is only one unforgivable sin in the "roughing-out" operations-not leaving the toolmaker enough stock, in the holes, on the outside diameters, and at the shoulder

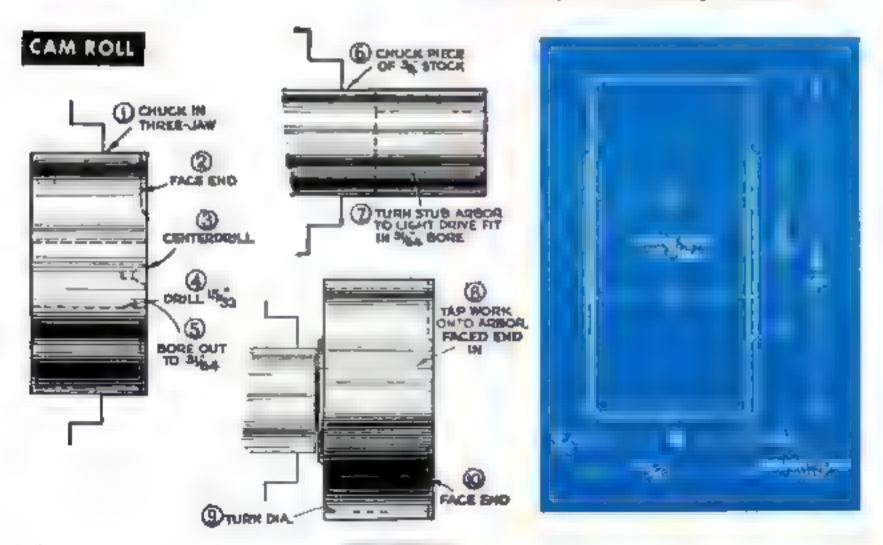
lengths, to "clean up the job."

If the piece is a roughed-out drill bushing, it is highly important that the hole be concentric with the outside diameters. When bushings are made from high-priced material, the rough blank often is furnished with only enough stock at the ends for a light rough and finish cut. In such a case, the rough blank is first chucked and the hole bored out, leaving the specified amount of stock for final finishing, to be done by the toolmaker later. Then the piece is placed on a soft steel arbor that runs "dead true," and



Typical of rush jobs is this special screw, the lack of which might knock a machine out of the production line. It's a simple chore for any workshopper who has mastered the technique of threading in the lathe.

Automatic machines of all kinds require many cam rolls and roll pins. Making replacements for these is one of the nuisance jobs that tie up toolrooms and skilled toolmakers, yet could be handled by the home-shop machinist.





Crutches daint stop Robert I Perme, of Indianapolis, from turning out a wide variety of gs and lixtures dianag World Wir II Here he's centering stock to turn a replacement for the scored I" lathe arbor lying on the cruss slide. The stock, chucked at one end, is supported in the steady rest. His old customers are now looking Perine up again.

the outside turned to size between centers.

An even quicker way is to chuck a piece of scrap steel in the lathe, turn it down so that the bushing can be driven on with a few light taps of a block of wood, and turn the outside in this manner. The need for concentricity between the hole and the outside diameter is obvious, for if the outside does not run true with the hole, there will not be enough stock left on it for finishing.

Next to his trusty little lathe, the home workshop defense worker needs a good handbook. Two of the standard handbooks are American Machinists' Handbook and Dictionary of Shop Terms, published by McGraw-Hill Book Company, New York; and Machinery's Handbook, published by The Industrial Press, New York. These are books that designers and machine shops use when making drawings of tools and standard parts.

In most instances—especially with tool shops—the customer is in a better position to supply the material he specifies for the job than the home-workshop operator. So make it the rule to have the material furnished.

Under no circumstances, if you spoil a piece of material furnished by a tool shop or defense plant, should you try to cover up your mistake by making a duplicate piece from your own material! Such ersatz won't take heat treatment properly.

How Much to Charge

Many tool shops are willing to pass out subcontracts on a "time and material basis." They furnish the material and you turn in

an honest report of the time you spent on the job, the pay ranging between \$2 and \$3 an hour. When you are cutting your eyeteeth on this sort of work, let the customer fix the rate of payment for the first few jobs. If he "plays you for a sucker," you can charge it off to experience, and use the information thus gained in estimating your costs for the next customer. Before long you'll be able to look at a simple drawing of a small part and tell offband, within 10 percent, how long it will take you to make it.

Give Your Customers Service

Nearly every busy tool shop and manufacturing plant would like to find another reliable source of supply that is open for business every working day—even if it is only from six to ten, evenings. The customer also wants a telephone number that he can call during regular business hours where some one is always available to relay a message to you. Always answer these calls, either by telephone or by personal visit, as soon as you can.

If you explain to your customers that giving them pickup and delivery service will cut into your limited productive time, some may arrange to have their truck deliver the raw material and work orders and pick up the finished work. Provide a box for each customer, so that you can place his finished work in it, along with his blueprints and any special tools he supplied for the job-such as a knurling tool, for instance—which his trucker can call for and pick up while you are absent from your basement shop during the day. This same box, by the way, offers an inviting convenience to the customer into which he can put the material and blueprints for the next job.

Where to Start

The newspaper advertisements for skilled toolmakers and machinists will indicate which shops in your vicinity need the sort of part-time service you have to offer. A place that operates any sort of power-driven machinery needs small repair jobs done. Local garages and service stations need armatures turned down. Plumbing shops often need some work done, such as facing and drilling a pipe flange to fit a special job. As a matter of fact, the problem for the home-workshop operator, in these hectic times, is not one of finding customers so much as being careful not to get swamped with rush jobs.

Case History of a Basement Defense Project

WHEN the U.S. Navy needed slides for its Link eye testers, three Ridgewood, N. J., men turned out 1,500 of them in a basement home shop. Working nights after a day-long stint in a defense plant, Floyd McGuckin, with his father John J. and his brother Lloyd, devised the semi-production

methods shown in these photos.

The slide had to fit a wooden scale and carry a card at the top and a big map pin at one side. To prevent bending of the pin when the device was packed, the McGuckins made it telescope into a piece of tubing. The card holders were made by winding stainless-steel wire on a mandrel in the lathe, and cutting every two turns apart. A retaining clip soldered over the ends held the ring on the slide. A tiny handle was affixed by a single screw through one side of the housing. Form turning tools in a tool-post turnet shaped and cut off the handles at one chucking. To tighten the screw, a special offset screwdriver had to be made.



lituusing was bent from a stamess-steel strap, hist punched for the handle screw. Three bends were then made on a homemade brake. The prect was closed over a steel bending form (in foreground) and a hole drilled for the rivet.



A flat opring in slide provided friction and kept it parallel to the scale. The spring ends were inserted in a slot and bent up. Rivet hole was punched and slipped on pin in the fig shown, where a square punch shaped the center for proper tension.

Short brass rivets were cut from wire in a jiffy on this gadget—two steel blocks aligned by loose pins, with mating grooves that formed a claimed for the ware. The notched, hardened cutter har was prvoted on a screw. Wire was fed from the bottom



Housing sides were riveted together with the spring inside. Then a recessed dimple for the handle retaining screw was formed with this anvil and punch. The conteal anvil was turned on the end of a screw and threaded into the flat base plate.

Tiny piece of tubing in which the map pin slid was held on for soldering by an adjustable clip made from a fiber block and a spring strip, as at right.







Tins chain saw fits the power take-off of any tractor or jeep. It notches, fells, and bucks fast, and is said to handle four-foot logs or small limbs with equal case. Design of the chain assures ample sawdust-carrying capacity. A safety clutch protects saw and operator, disengaging the saw if it is pinched or encounters an obstruction. Von Ruden Mfg. Co., Claremont, Minn., makes it.

Tip for Christmas Tree Safety

CHRISTALAS trees are less of a fire hazard if sprayed with a solution made of 9 oz. borax and 4 oz. boric acid in a gallon of water. Other inflammable Christmas decorations can be dipped in the same solution.

My Most Ingenious Solution



I needed gas to wash engine parts. Instead of getting a mouthful of gas when I syphoned it from the tank, I got the gas where it belonged—in the bucket, What do you think I did?

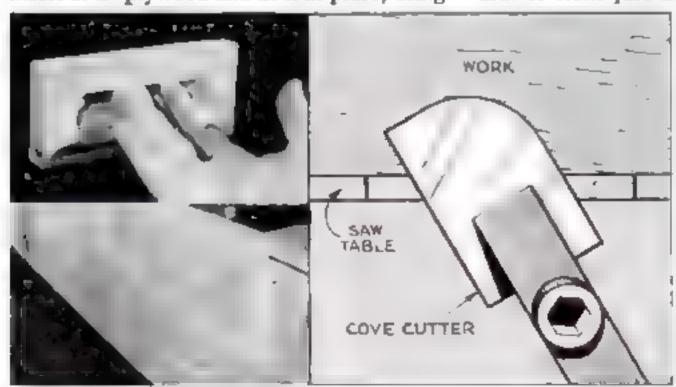
On the end of a wire, I tied a wad of rage. I pushed the wire down the hose until the rage were in the gas in the tank. Then I yanked the wire and wad out. That pulled the air out of the hose and the gas followed.—Ralph Wuant, Indianapolis, Ind.

How to Cut Recessed Drawer Pulls on a Circular Saw

RECESSED drawer pulls eliminate the need of extra hardware, make finishing easier, and have a clean, modern look that's especially good with built-in cabinets. Though making them by hand would be laborious, they can be cut in a moment on any standard circular saw.

Replace the blade with a molding head carrying %" cove cutters. Cut a blank table insert of %" plywood and fit it in place, using

wedges if necessary to get a tight fit. Tilt the table or arbor 45°, check to be sure the lowered cutters are clear, and start the motor. Then raise the arbor (or lower the table) until the blades cut their way through the new insert and project about \$" above. Count the exact number of handwheel turns needed to raise the cutters \$". Use the fence and clamped-on stop blocks to locate the drawer front just the right place.



Now you're ready to cut the recessed pull. With the cutters below the surface and the work in place, start the motor, turn the handwheel the measured number of times, and lower the cutters again before lifting off the finished piece. The method is suggested by the Jet Tool Co., of San Diego, which makes molding heads and cutters.

It's a midget, about andway in size between an airbrush and ordinary spray gun, but this sprayer will serve you well. Designed and made by Walter E. Burton, of Akron, Ohio, it handles well-thinned lacquer, enamel, model-airplane done, and other bouids.



A Homemade Sprayer Does Touch-up Jobs

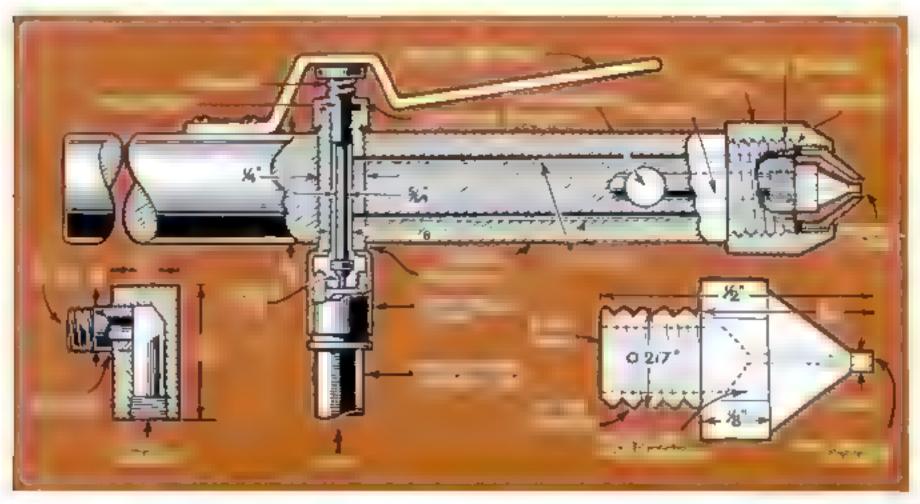
AVALVE from an old inner tube controls the air flow in this little spray gun, a homemade tool that you will find handy for many small painting jobs. To work it, you press a lever. This depresses a pushrod, opening the valve. Air escaping from the rozzic creates suction that draws out paint.

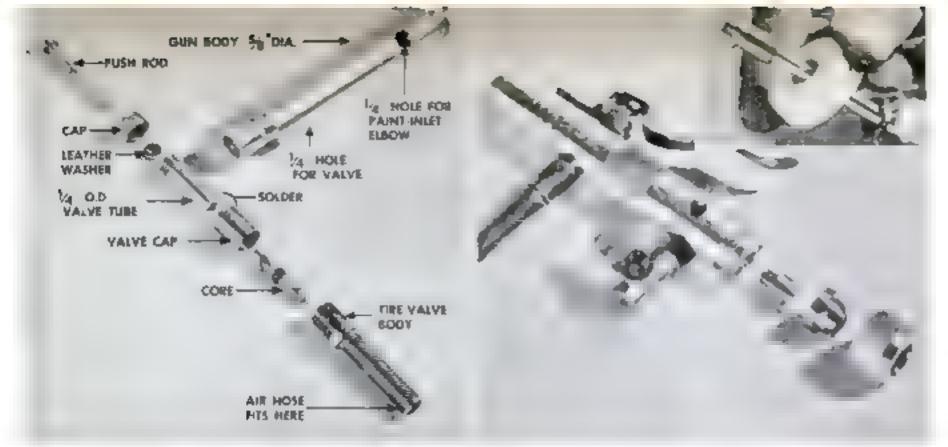
The valve assembly. Cut the tip from the tire-valve cap (if it's the kind that has a core-screwing tip) and drill a %" hole through the top. Convert a %" piece of %" rod into a tube by drilling a %" hole lengthwise. Thread one end for a screw cap, Silversolder the other to the tire-valve cap.

Turn a pushrod from K" rod, making the upper end a sliding fit in the K" tube. For most of its length, however, turn down the pushrod to 5/64" diameter. An oiled leather washer under the top cap keeps air from escaping.

Making the body. Use a 4" or 5" length of 3" aluminum or brass rod. About 23" from the nozzle end, drill a scant 3" hole crosswise for the valve tube. With the tube press-fitted in place, dail two 3/32" lengthwise holes into the tube from the nozzle end of the body

To carry paint to the nozzle, center a hole in the end of the body, using a No. 21 drill. Tap this 10-32 for the paint tip. Drill a %" hole at right angles into this lengthwise hole





Here are the valve parts. Gun body (upper right) was made in two pieces because longer stock was lacking. An extension, not shown, was driven on shoulder turned on the piece above.

Nozzle parts are adjusted by trial. Piece of brass soldered on inlet cloow hooks over pin on gun to keep elbow from turning. Not clamps tube (inset) to jar cap, which has air-intake hole,

and tup it X"-20 for the paint-inlet elbow.

The nozzle assembly. It's best to make all three parts of brass. Critical dimensions are given in the drawing. The paint-delivery tip can be turned from %" rod. The relationship between air and paint openings can best be adjusted by trial.

Attaching the paint jar, Make an elbow from two pieces of brass as shown in the drawing. Any small jar with a screw cap can be used. Fit a length of K" o.d. brass tubing through the cap and thread the upper end to fit the elbow. Push a brass flange over the tubing and solder it in position. A nut turned up from below will then clamp the tube to the jar cap. Punch a small air hole in the lid.

The gun should operate well on 20-pound air pressure. The spray characteristics will depend largely on the position of the outer air shell in relation to the inner paint tip. If the gun fails to spray, the gasket that regulates the position of the air shell may be either too thick or too thin.

Simple Chemical Magic Changes Name to Caricature

Using only ordinary ink, starch, laundry blench, and two common drugstore chemicals, you can builte your friends with this amazing stunt of presto-change. The name of a person is written on a piece of paper, which is then inserted in a glass jar. Therebefore everyone's eyes—his name disappears and his caricature takes its place.

The trick requires preparation, naturally. First draw the caricature in invisible ink that is made by mixing a pinch of potassium iodide and a pinch of cornstarch in a table-spoonful of water, and heating for several minutes to dissolve the starch. When you write the name, use any ink that can be removed with ordinary ink remover, and dilute it 1 part ink to 15 parts water.

It is a whilf of chlorine gas in the jar that does it. It bleaches the ordinary ink and releases the brown-colored free iodine in the invisible ink. You can make the small amount of chlorine needed right in the jar. Just cover the bottom with sodium hypochlorite bleach (laundry aids such as Clorox



or Dazzle), and then add a little hydrochloric acid. You can get a few cents' worth of this, as well as the potassium iodide, at the corner drugstore. Handle the acid carefully, add it slowly, and don't inhale the irritating gas that fills the jar. A stiff card over the top will close the jar.—Kenneth M. Swezey, Brooklyn, N. Y.

Here's a Novel Way to Give Your Christmas Tree a Lift

This year use a gaily decorated stand to add to the glamour of your tree. To make the base, cut down the legs of a table or stool, and use a small wooden box for the upper tier. Nail crosspieces to the bottom of the tree trunk, stand the tree in the box, and pack it with sand. The jigsawed cutouts can be hand-painted or enlivened with holiday decals. The wistful angels pictured at the right are the work of Peter Hunt. The upper tier alone will easily hold a small table-top tree.

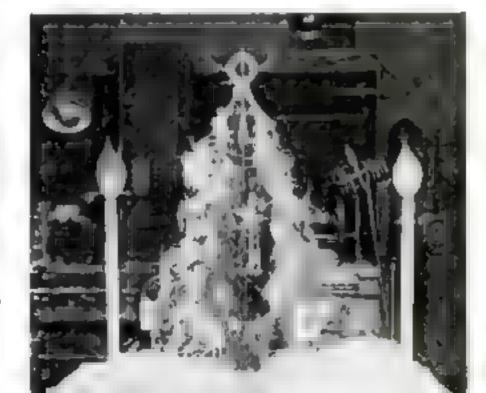


Here's a Make-Belleve Yule Tree That You Can Hang on a Closet Door

If you haven't space for the traditional holiday tree, you can have one on a door or wall. The jigsawed job at the left is another Peter Hunt folk design. It was cut from a piece of plywood. Any large half-round form such as an old table leg or a newel post sawed through the middle can be used as a base. Old chair legs and spindles or stair balusters serve incely for the angels. Cut them to size and tack on plywood wings. Use drawer pulls with a hole drilled at the center for the candleholders.

And Here's How to Make a Shop Tree

WANT real Christmas atmosphere for a shop party? Take a tip from the machine-shop staff of the Atomic Energy Commission's New York Operations. They made the tree at right from four plywood cutouts, trimmed it with a fancy collection of gears, wheels, stampings, small tools, and scrap. Lathe shavings supplied the icing, and burned-out fluorescent lamps were used to make the candles.



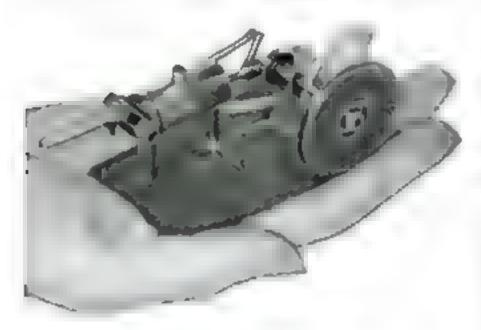
DECEMBER 1950 195



It's ALWAYS a thrill to build something that runs. This little steam engine has plenty of zip and an eye-catching valve action. Hooked to a toy boiler, bicycle pump, air tank, or carbon dioxide cylinder, it will run a model or a midget electric generator with enthusiasm.

So long as you use only air, CO₅, or lowpressure steam, you can safely assemble the engine with soft solder, like the one shown. For hot steam, above 15 lb., better use silver solder.

The cylinder is brass tubing. Smooth the bore by wrapping very fine abrasive cloth around a rod and working it back and forth in the cylinder. If you can find another piece of tubing that is a good sliding fit in the bore, make the piston by solder-



In just two evenings
you can build this
palm-sized power plant.

ing a disk on one end. Otherwise, turn aluminum or brass to a shakeless but free-running fit in the cylinder, turn two oil grooves, and drill in from an end to lighten the piece.

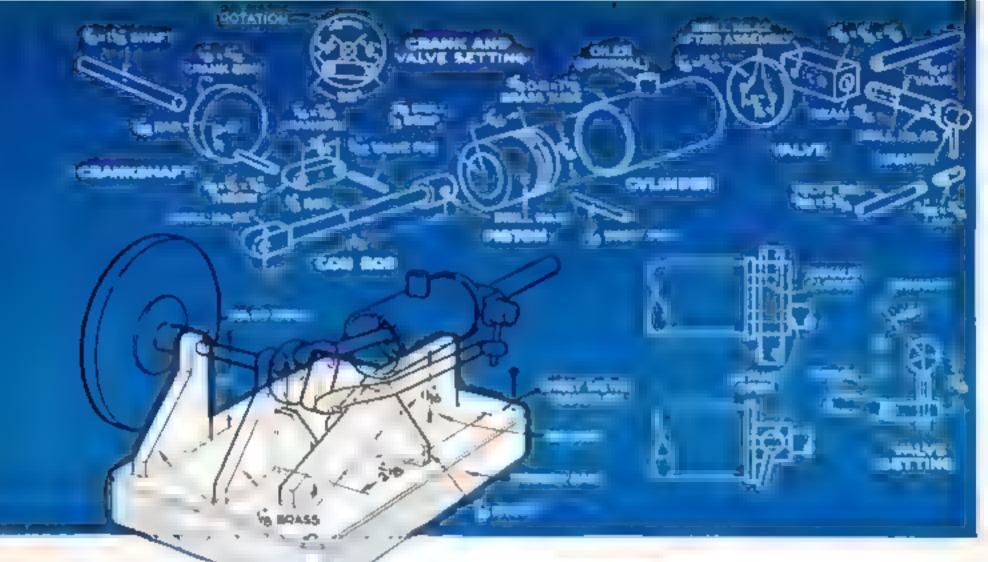
Cut a disk of sheet brass for the cylinder head, and a length of square or hex stock for the valve housing. Drill a No. 13 hole lengthwise through this for the oscillating valve. Spot two punch marks 5/16" apart on a diameter of the disk. Then solder the disk to the cylinder and the valve housing to the disk, parallel to the punch marks.

Run a No. 42 drill from the open end of the cylinder into the punch marks to form the ports. The intake port runs right through the valve housing; the other just into the No. 13 hole.

Cut a piece of 3/16" brass rod to length for the valve and solder a washer %" from one end. Insert it in the valve bousing after running a No. 12 drill or a 3/16" reamer through. Then drill through the exhaust port half way into the valve. Rotate the valve 75° and drill the intake port through.

Remove the valve to drill a hole outside the washer, displaced 40° from the exhaust port, for the pin that carries the valve-rod link. Also drill a hole lengthwise from the other end to meet the exhaust port and open it to the air.

Solder a short piece of tubing over the intake port on the valve housing as a steam inlet. Then slip the valve into the housing, and carefully solder a second washer on the exhaust end to retain it.



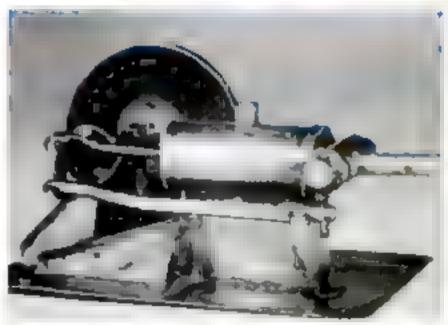
be sawed from K" brass, or bent up of sheet metal, with solid bearings soldered on. Solder the cylinder in place cautiously so as not to overheat and loosen the valve

Drive the crankshaft into the crank disk, after you've drilled a No. 53 hole on a 7-32" radius. In this, drive and solder a 1-16" crankpin. Make the con rod by soldering or screwing endpieces onto a %" rod. Put the con rod on the crankpin before soldering on the outside throw. Position the throw to bring the valve pin 90° ahead of the crankpin and on a %" radius.

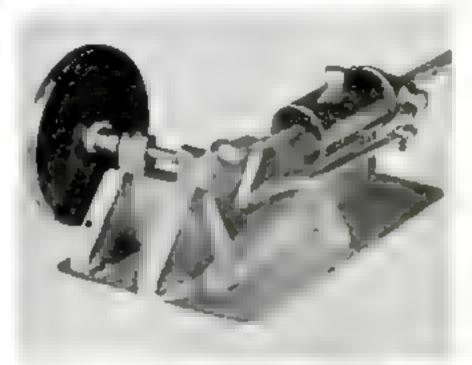
The flywheel shown was made by soldering a 1%" steel washer onto a brass hub drilled a press fit on the crankshaft. If you can't get a flywheel from an old toy, you can cast one of lead or turn one from solid stock, a faucet handwheel, or the like.

The 3/32" valve rod is about 2%" long. Bend an offset in it as shown in the photos. Assemble it with 1/16" pins and check the valve action. The ports should be wide open when the piston is midway on its stroke—that is, with the crankpin at the top or bottom of its circle. Some valve adjustment can be made by bending the valve rod to shorten it slightly. If the exhaust valve doesn't open all the way, a longer rod should be substituted.

If everything works freely, the engine should run on as little as 2 lb. pressure. A hole drilled halfway along the cylinder, with a bit of tubing soldered over it as an oil cup, keeps the piston lubricated—W. M. Dierks, Chicago.



Rocker valve action is driven by an extra crank throw displaced 90° from connecting-rod crankpin. The inlet tube can be connected to a boiler or air source by rubber tubing.



Business end of engine shows solid bearings soldered onto supports bent up from sheet metal. The short tube on top of the cylinder is an oil cup for hibricating the piston.

Last-Minute Gifts Anyone Can Make



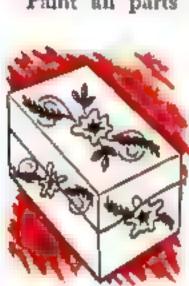
IF YOU still have half your relatives unaccounted for on your Christmas list and you can't face the calendar without shuddering, here are some gifts that will fill a lot of

empty stockings in a hurry. The dime-store parts are easy to come by and in a single evening you can add any one of these

quickies to your bulging pack.

To make the two-tier tray shown in the photograph, find the centers of both pie pans. With a compass, draw a circle on the underside of the larger pan %" smaller than the diameter of the wooden spacer—a cylinder of wood 3" long cut from a curtain rod or a closet pole. Punch three equally spaced holes within this circle. Cut the spacer ends perfectly square and invert the pan over one end, centering the three holes on it. Spot the holes through to the wood and drill and countersink them in the spacer. Drill a small, deep center hole in the opposite end of the spacer and punch a single center hole from the underside of the smaller pan.

Paint all parts and let them dry over-



Want to pep up the kitchen? This is purely a decorating job. Enamel a recipe file box whate, trace on some handsome steneils and fill in with colors. Or enamel the box black, center a stylized initial and paint it and some surrounding scrollwork in gold.



night. Screw the bottom pan to the spacer with flathead screws. Place the small pan over the single hole in the spacer, with the spool on top of it, and drive the awl in tightly to hold the whole assembly together. Add free-hand decorations or decals. END

Solder a hinge to two pie pans to make a silent butler. Add a pot-hid knob for lifting the cover Hacksaw the end of a file handle to fit and attach to the lower pan with a wood screw. If a light frying pan is used for the bottom container, it supplies its own handle.

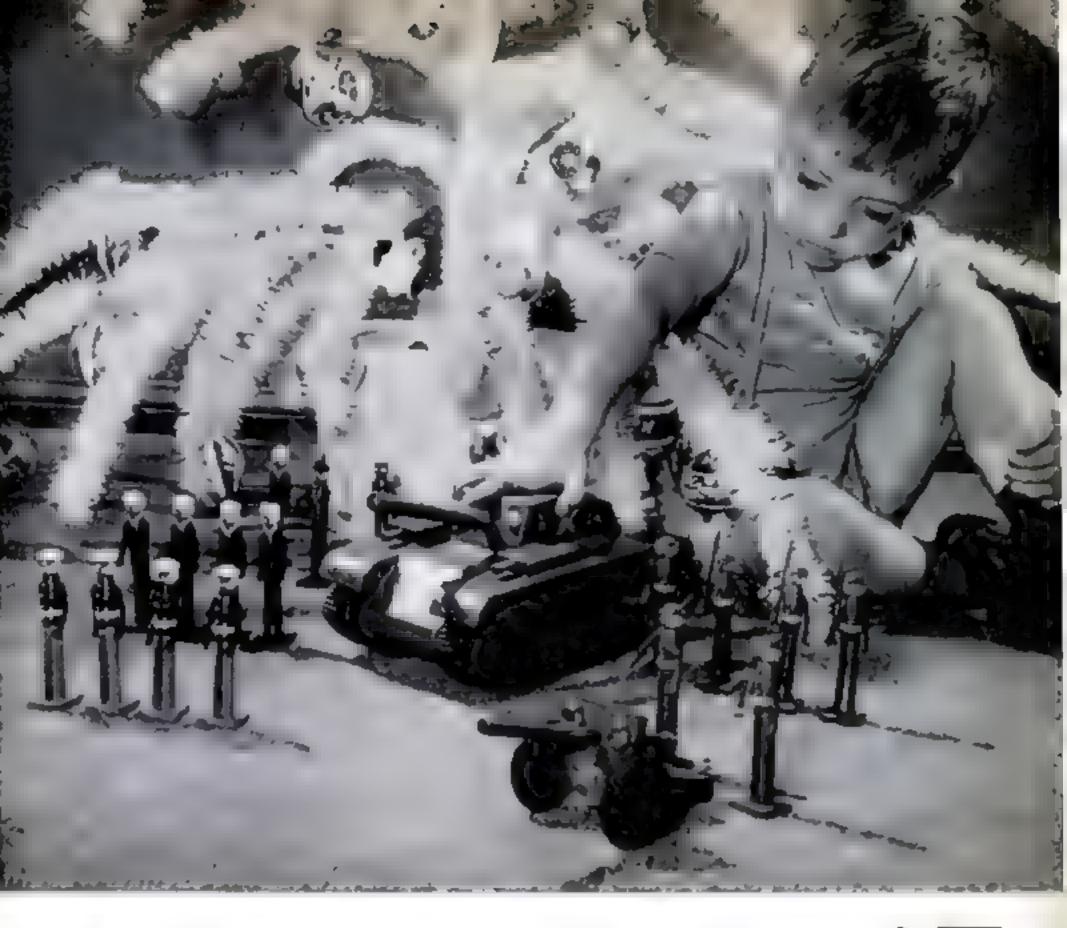




Cut a pie pan into two parts, slightly off center, and you have a crumb tray and shovel. Snip the rolled edges with heavy side-cutting phers and cut across the tin with tin snips. File the edges smooth, enamel, and decorate. Attach colorful plastic cabinet handles.

Every family has one ardent horticulturist. Please yours with this window-sill planter, made by decorating a 4%" by 13" bread pan or cake-loaf tin. Before planting, fill the tin with an inch-high layer of pieces from a broken clay flowerpot. This will allow drainage.





For Future Generals



These clothespin troops maneuver with a realistic wooden tank and a field gun.

By Herbert Pfister

PS STAFF PHOTOE

DEPLOY this toy task force under the tree on Christmas morning and watch your boy's eyes light up.

The troops, the tank, and the field gun look like those that the children have seen in parades. There are soldiers, sailors, and marines—even an admiral—in this unified nursery defense force.

And the big feature is simple construction. Your scrap box will furnish the main parts of

the tank. The troops are made of clothespins, washers, and tacks. Two pieces of wood and wheels from an old toy make the field gun. Its barrel is the tube of an old percolator. All the toys can be cut to shape and put together with your hand tools. Turn the page to see how you can make them.

The tank: Here's what you'll need:

15" of 2" by 3" pine.

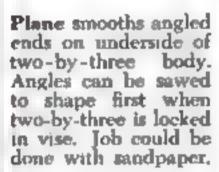
12" plywood 212" by 912"
2 pieces of 12" pine 114"
by 214" for small turrets.
2 14" dowels 112" long.
14" dowel 6" long.
14 thread spools 114" by

12 squarehead lag screws
4" by 24".
1 squarehead machine bolt
14" by 6"
2 screw eyes.
2 upholstery tacks.
3 sticker stars.

rubber floor matting.



Chisel removes wood to form slot across one end of two-by-three body. First make two saw cuts to form sides of slot. Use of slot is shown in photo at bottom of this page.

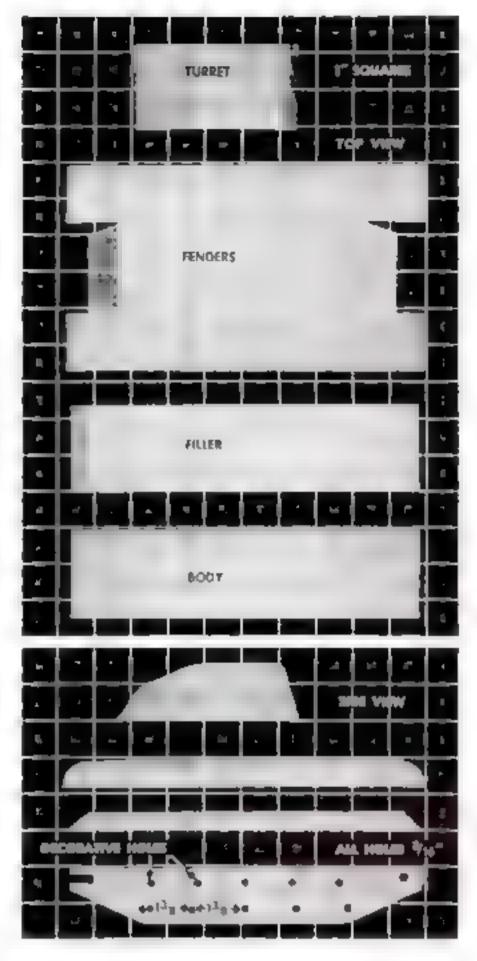


Saw cuts outline waste to be removed at each end of fender piece. This is done after fenders, filler, and body are assembled. Then chisel out waste between saw cuts.

Rasp then lines up ungles at each end of fenders with angle already sawed in ends of filler. File will do job, but is slower. This is top view before turret was mounted,

File squares up shoulders at the ends of a spool. Otherwise the shoulders would cause treads to ride up out of spools. Hand drill turns spool while file takes off shoulder.

Shim in slot is used to tighten threads. The two rear spools are mounted on 6" machine bolt. If treads are loose, put a shim in slot behind bolt to move spools outward.



The photos above laid off on squares give you the dimensions for the body of the tank and the step-by-step photos at left show you how to make the parts. The small turrets are not shown, but their construction is obvious.

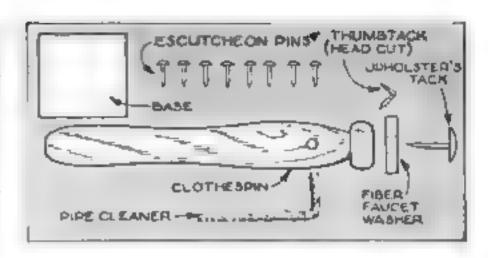
If you want to, you can leave out the five decorative holes in each side of the two-by-three. They were put in just to break up the blank space above the idlers and to give the appearance of part of the tank's running gear. Two strips of rubber floor matting are ideal for the treads. After you cut the strips to size, sew the ends together to make two continuous belts.

Twelve of the spools are held to the twoby-three by lag screws. The two rear spools —one on each side—are held by the machine bolt that fits in the slot.



200 POPULAR SCIENCE

The troops. Their bodies are clothespins glued on 1" by 1" bases of 3" composition wood. Pipe cleaners pushed through holes drilled in the bodies form the arms. You'll have to cut off the pipe cleaners to shorten the arms. The belts are masking tape and the red stripes down the marines' trousers are cellulose tape. All the buttons are %" escutcheon pins.



Here are details and color schemes for the troops.

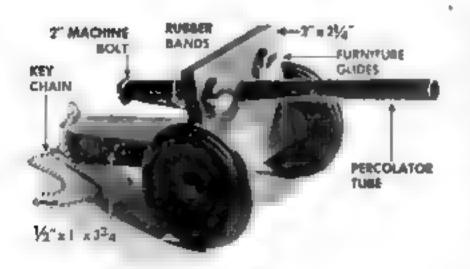
cuffs and epaulets. to make.

The admiral. His hat The sailor. His cap is The marine. His cap or topped by a roundis a stamped wing not a %" fiber faucet washer is like the sailor's, but headed upholstery tack. held on his head by a and an upholstery tack with a visor added. The The rifle is a 25" cotter roundheaded upholstery. His collar is masking visor is a thumb tack pin with 3" clipped off tack. Colors: hat, dark tape painted white. Col- with half the head cut the short leg. One end blue edged with gold, ors. body, blue; cap, off Colors: cap, white; of his arm is twisted in body, dark blue; arms, white. The sailor is the visor, black; jacket, dark the head of the cotter dark blue with gold easiest one of the troops blue; trousens, light pin, Colors; rifle, blue;

blue; belt, white.

The soldier. His helmet is a %" metal washbody, olive drab.





The field gun. This is a simple glue job. The shield and trail are glued together and the percolator-tube barrel is glued into a hole drilled in the shield. The plunger-a machine bolt-that fires short pieces of dowel for projectiles is powered by a rubber band. The rubber is looped through a screw eye in the rear of the shield and through a slot in the head of the bolt. With the exception of the furniture glides and wheels, the gun is painted olive drab.

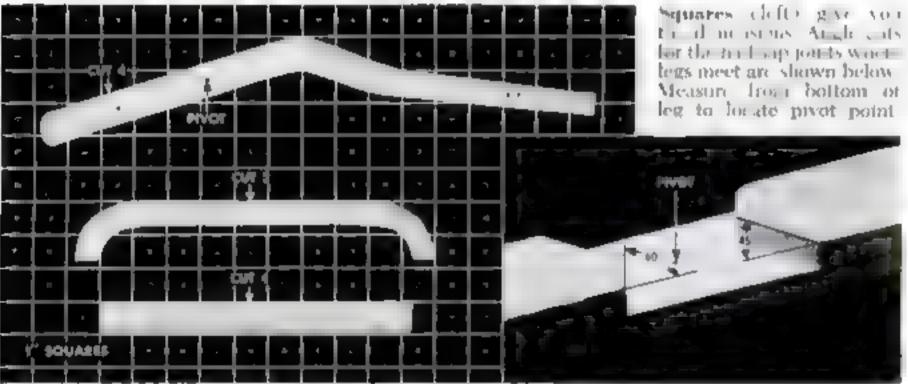


Knitting Bag Stands Up

THIS folding bag stands on its own feet and has countless uses. It's handy for sewing, as a carrier for baby things, and you can take it to the beach next summer to keep your books and cigarettes out of the sand.

Enlarge and transfer the patterns to %" hardwood, and bandsaw out. When you cut the angled half-lap joints, make the cuts on one side of two pieces and on the opposite side of the other two. Assemble with dowels and glue, using small bolts for the pivots.

Ask your wife to make the bag from a 12%" by 18" piece of fabric, gathered along the sides to give a cupped shape.—John A Vincenti, Kennett Square, Pa.



Miniature Utensils for a Kitchen Whatnot Shelf

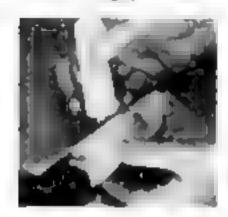


Scraps of metal are used by Charles H. Hardy of Los Angeles to turn out miniature kitchen tools, many of them with working parts. The old-fashioned coffee grinder has a tiny grinding unit and a shding drawer.

The mixer has a tilting head and its enameled copper bowl revolves on a turntable. The copper coffepot has a hinged lid, and the kettle has both a removable lid and a spout that pours.



These parts, plus the bottle, make an attractive candle lamp. You have a choice of bulbs, including the candle-flame type, center. All are low waitage, suitable for night lights.



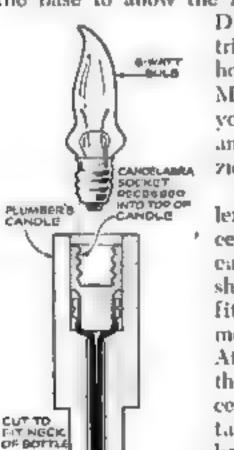
To add to the realistic appearance of your candle lamp, drip some wax from another candle down the neck and onto the bottle. Seal the candle to the month of the bottle with soft wax.



How to Make Electric Candles

FOR soft, quiet light, there's nothing like a candle—except an electric candle. This one is an ideal night light or subdued TV lamp.

You can make a candle lamp out of any attractive bottle, a plumber's candle, and a small bulb and socket. First step is to select the bottle—preferably one made of deeptoned glass. Next drill a small hole near the base to allow the lamp cord to enter.



Drilling glass is a tricky job. For tips on how to do it, see PS. March '49, p. 239. Or you can play it safe and let the local glazier do it for you.

Drill a %" hole lengthwise through the center of a plumber's candle, and carve a shoulder at one end to fit snugly into the mouth of the bottle. At the other end of the candle widen the center hole enough to take a small, card-hoard-sheathed candelabra socket. ("Candelabra" means a lamp base slightly larger

than either the miniature flashlight or Christmas-tree lamp size.)

Bring the lamp cord through the bottle, wire the socket, and your lamp is practically finished. For extra realism, you can melt some wax drippings around the candle neck and down the sides of the bottle.

Geiger Counter for Experimenters

There'll be a Geiger counter in every schoolboy's shop if the makers continue to develop inexpensive models. This one, called the Raytector Kit, sells for \$17.50 and is made by Batson Electronics, Inc., Omaha, Nebr. It uses both a headphone and neon flasher to indicate the strength of radioactive materials and operates on a single flashlight battery.





T-Foot Tea Table

By Joseph Aronson

Designer, author of the Encyclopedia of Furniture

JUST big enough for ash tray, book, glass, or cup and saucer, this portable chairside stand will add to any room. The T-foot design comes from an early American table.

Like the old-time cabinetmakers, you can build the table of any unmatched lumber odds and ends. And don't worry too much about the dimensions. You can vary the proportions quite a bit.

A nicely grained square of maple makes the top. The shaft is pine, and the foot is maple. It's best to dowel together the foot parts and then dowel up into the shaft, but screws set in as shown make the job easier. Screw the top plate to the upper end of the shaft. Then screw the finished top to the plate from underneath. Apply glue to all joints.

Sand off the hard edges. Finish with auto wax to which a touch of burnt sienna in turpentine has been added.

Keep Your TV Screen Clean

You may be able to brighten and improve the picture on your TV screen just by cleaning fingerprints and dust off the safety shield in front of the tube face. Use any mild window spray or cleaner. If the safety shield is plastic, wipe it with a very soft cloth to avoid scratches, which are difficult to remove. Do not apply too much pressure.—

H. Leeper, Canton, Ohio.





What You Should Know About TV Antennas

There are as many ways of catching signals as there are to skin a cat... Which is best where you live?

By Robert Hertzberg

WHETHER your receiver cost \$49.50 or \$499.50, it has to catch TV signals to produce bright, sharp pictures. Your signal-catcher is your antenna. Luckily, it is something that you often can experiment with profitably, even though you don't know a

ELECTRICAL SHADOWS AND REFLECTIONS

A steel-frame building or other large structure may block off signals, making a receiver in the shadow area useless. This effect is particularly marked on the high-frequency channels.

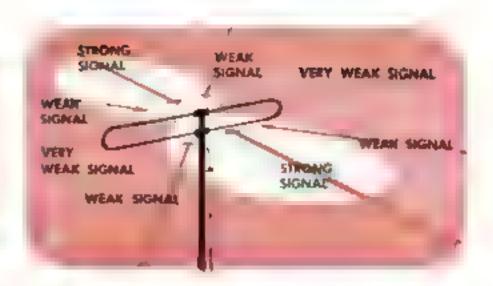
Behaving like light waves, TV impulses under fortunate conditions are sometimes reflected from buildings into receiving aerials in shadow areas. Satisfactory pictures are thus obtained.





DIRECTIONAL PATTERNS

Basic folded dipole (1) receives equally well front and back, poorly off its ends. Reflector added to dipole (2) reduces signals and interference from back, but increases pickup from front. Multi-element automa (3), with director rods in front of dipole and reflector behind, is called a "Yagi." It is sharply directional in forward plane, has practically no response to side and back, and responds with very high efficiency to signals of single frequency that corresponds to length and spacing of elements.



thing about the complicated innards of a video receiver.

You don't need a single meter or other piece of special equipment. Poles, rods, and wires can be re-arranged with common hand tools. And you may not even have to do any fancy climbing—trial set-ups in the attic may show what can be done where you live with various kinds of antennas. But it helps to know a little about the way TV pictures fly through the air.

Electronic lighthouse. Think of a television transmitter as an electronic lighthouse that shoots out flat circles of invisible waves. These waves respond to focusing, but peter out rapidly as they advance, and can be blocked or reflected by obstacles such as hills and good-sized buildings.

In the U.S., the waves are polarized horizontally. In England, they are polarized verticully, and receiving antennas there look like fishing poles. But our experts chose horizontal polarization, because much of the interference from electrical machinery is vertically polarized, and antennas in this country work better when they are horizontal.

The earth's curvature, height of the transmitting aerial, and the height and position of your own antenna limit the distance at which signals can be caught consistently. This distance is not likely to be more than

75 miles, although many cases of successful reception at greater distances have been reported.

Where are you? If you live out in the wide open spaces, your freedom from interference and ability to place your antenna wherever you please may help you catch TV shows.

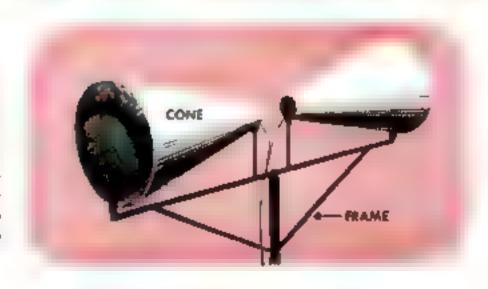
All sorts of things can happen in cities. A woman in a New York apartment enjoyed excellent reception with a simple indoor antenna until she lowered her blinds. Then the screen went blank because the aluminum slats formed a perfect shield.

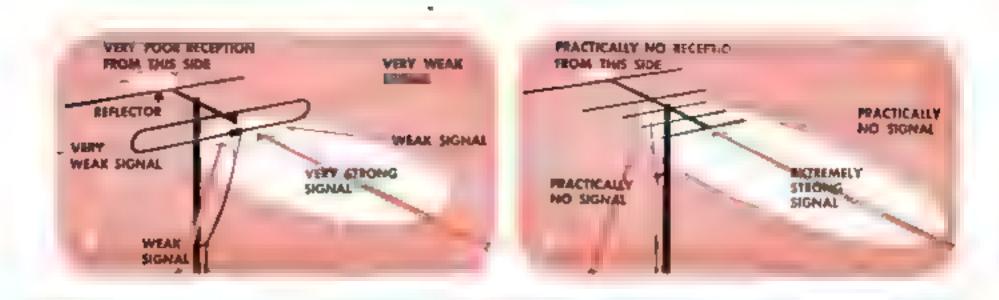
A building between your antenna and the transmitting aerial may cast an electrical shadow within which reception is poor or hopeless. Another building may reflect the signals into such a dead spot, and make good reception possible. Or several buildings may act as mirrors and shine several signals into an antenna, producing that multiplicity of images commonly known as ghosts.

How dipoles are made. The simplest type of signal catcher is a single dipole—a straight rod, tube, or wire about half as long as the waves from the transmitter. It is cut in half, the inside ends are pulled apart a half inch or so, and the two conductors of the lead-in wire are attached to these two halves.

DEVELOPMENT OF CONICAL DIPOLE

Electronically, a dipole consisting of two enclosed metal cones (1) makes an effective broadband antenna, but mechanically it is impractical. Desirable characteristics remain when cones are replaced by basket-weave arrangement of wires (2), or by rods forming V-shaped legs (3). This modified conical, with reflector to give directional pattern similar to that of folded dipole with reflector, is popular because it is easy to erect and pulls strong signals from stations up to about 25 miles away.





The over-all length of a single dipole cut to receive Channel 4 is 80 inches. For Channel 13, by mere coincidence, each arm should be only about 13 inches long. (PS, Sept. '50, p. 237). Inexpensive aluminum tubing, about %" or %" in diameter, is usually used because it is self-supporting and easy to mount. Copper or brass tubing would serve just as well.

Such a dipole receives best from the directions at right angles to the rod. You may not notice any difference if the rod is awung 15° to 20° to either side of the true compass bearing of the source of the signal you want to catch. Nevertheless, this directional effect is often useful in eliminating ghosts.

Folding the dipole. Unfortunately, a simple dipole, cut to the proper length to eatch the signals from one station, may not bring in stations on other channels equally well. This difference in the response to different stations can be reduced, however, by "doubling" the dipole. This is done by folding a rod twice as long as would be needed for a simple dipole into a trombone shape.

A folded dipole has the same directional characteristics as a single dipole. But a double dipole cut to the proper length for Channel 4 will usually work better on Channels 3 and 5, and 2 and 6, than a single dipole of the same length.

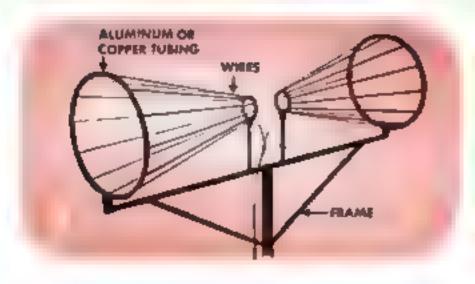
These channels, 2 to 6 inclusive, constitute the low band of TV frequencies. The other channels, 7 to 13 inclusive, are the high band, and to receive them, a separate, shorter dipole is often added to an antenna.

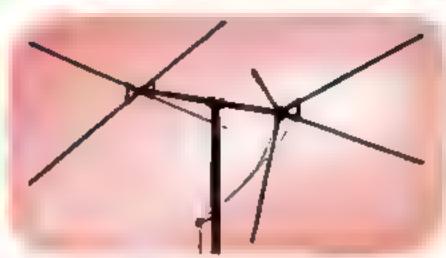
Adding a reflector. There also are other ways of improving a dipole's performance. A separate, slightly longer rod, for example, can be fastened to a crossarm on the mast so that it will be in a horizontal plane behind the dipole and serve as a reflector. No wires are attached to this extra rod—but its spacing in relation to the dipole is somewhat critical.

Its distance behind the dipole should be between a tenth and a quarter of the length of the desired incoming waves. When this distance is right, the extra rod picks up energy from the station toward which the dipole has been faced and bounces this additional energy back into the dipole. And at the same time it serves as a shield against waves coming from the rear that might interfere with the reception of the desired signals.

Adding a director. An unconnected rod can also be placed in front of a dipole. It then becomes a director if it is made a trifle shorter than the dipole, and spaced so that energy is re-radiated from it to the dipole to strengthen the signal received.

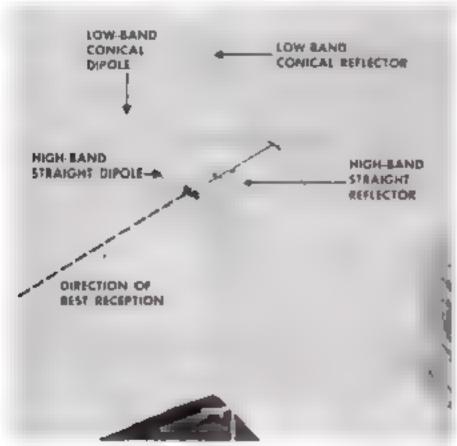
When a director is used, the spacing is



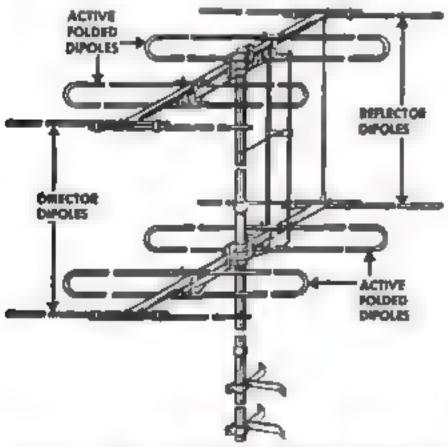


extremely important. It is roughly a tenth of a wavelength (one fifth the length of the dipole), but should be adjusted on the spot for best results. If this spacing is wrong, the secondary signals that the director shoves into the dipole will tend to cancel out the signal that the dipole picked up on its own hook, and the result will be a poor picture or no picture.

The more reflectors and directors that you add to an antenna, the more heartily it can feed signals into your receiving set—but



Typical medified conical entense, with additional high-band dipole and reflector to give extra gain on channels 7 to 13, is shown above. Direction of best reception is to left.



Special stacked twin-driven "Yagi" antenna, for use on a single channel in fringe areas or other difficult locations. Directional effect is very sharp; spacing of elements is critical.

at the same time the directional or beam effect of the antenna becomes narrower. Hence, such an antenna is most likely to be desirable where you only hope to receive the signals from one station or from stations that are geographically aligned.

A particularly useful type of antenna has five elements and is called a Yagi after a Japanese engineer who worked out its tricky spacing. A Yagi has three director rods, a dipole, and one reflector. Pointing one of these things is almost like shooting with a rifle.

Stacking 'em up. It is also feasible to mount several ordinary two-element beam antennas, one over the other, on a common pole, with a common lead-in. Such an arrangement is called a "stacked array."

Its advantage over the Yagi is that it retains the relatively broad-band frequency coverage of the basic dipole. But a stacked array can become clumsy. A stacked array having four two-element beams, for example, may require a reinforced tower of some kind.

Conical frames. Probably the best general-purpose TV serial, electronically, would be a dipole with the elements in the form of closed metal cones. As a mechanical body it is impractical. Its desirable broad-band characteristics can be largely retained, however, by replacing the cones with a basket-like arrangement of wires. And experimenters who kept removing a few wires at a time discovered that such an antenna still worked well with only two rods on each side, fanned out to form a wide V.

This modified "conical" can be backed up with reflectors and stacked in the form of arrays, and is proving successful where the available stations are distributed over both low and high bands.

But the directional property of beam antennas is not an unmixed blessing. Suppose you live between two stations. If you aim your antenna at one, you may not get a glimmer out of the other station. But there are two ways to overcome this trouble: Use two antennas and switch from one to the other, or make your antenna rotate so that it can be simed at either station.

Tricks such as these are enabling the kids to enjoy Hopalong Cassidy where satisfactory reception would be impossible otherwise.

Next month POPULAR SCIENCE will report "The Best Ways to Mount TV Antennas."

How to Hush Your TV Set

You can escape the kids' pictures by leaving the room. Don't let the sound follow you.

PEACE in a television home is easily restored—if you provide earphones. Gun-shy parents then can enjoy their newspapers while the children watch the cowboys and Indians. And the kids can sleep undisturbed while father catches a late wrestling match or prize fight.

An "earphone attachment" is simply a 2" by 4" strip of plywood or composition board on which a standard phone jack and a single pole, double throw toggle switch

have been mounted. It can be attached to the back edge of the cabinet or screwed to any convenient ledge near the receiver.

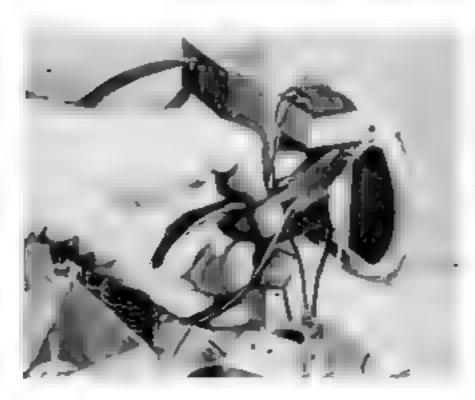
The hardest part of the job is getting at the loudspeaker. Many cabinets are put together in sections, and the top or front panel can be unscrewed for ready access. But in other cases the chassis may have to be taken out. To do this, pull off the knobs and loosen the bottom bolts. Then make sure that the front of the picture tube is firmly sup-

Tired of having heavy bombers roar down at you out of the TV skies? Let others listen through earphones without disturbing you



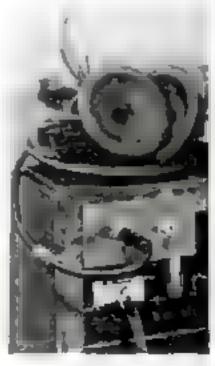
ported when you slide the assembly out.

To add earphones you have to cut only one wire in the receiver. Between the speaker and the output transformer—which is usually bolted on the speaker frame—there are two stiff-wire voice-coil leads. Snip either one of these leads. Solder extensions to the cut ends and bring them to the toggle switch. When the switch is in one position, the set will operate exactly as before. Solder another wire to the other side of the



Cutting either of two voice-coil leads is only change needed in receiver. Snipped ends go to toggle switch. Make sure picture tube is supported if you remove chassis from cabinet.

Small panel for phone jack and toggle switch may be mounted at back of cabmet or near set. Condensers are on other side of strip. Surplus Army phones come equipped with plug.



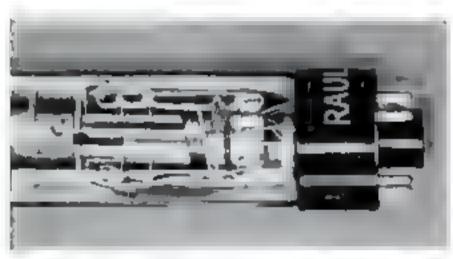
DECEMBER 1950 789

speaker voice coil and connect an earphone jack and two condensers, as in the drawing.

There is no danger from shock, as the earphones are isolated from the high-voltage portions of the circuit by the output transformer and additionally protected by the condensers in series with the speaker leads. These condensers may be of any capacity from .05 to .25 mfd.; rated working voltage should be 300 volts or more.

The earphones may be either the low- or high-impedance type. Signal Corps surplus phones are fine. As many as a dozen pairs can be used simultaneously if extra jacks are connected in parallel. Kids love to wear phones: they give 'em that Captain Video appearance.

P.S. You can use exactly the same rig on any radio if you want to protect yourself against old-fashioned ear-busters.



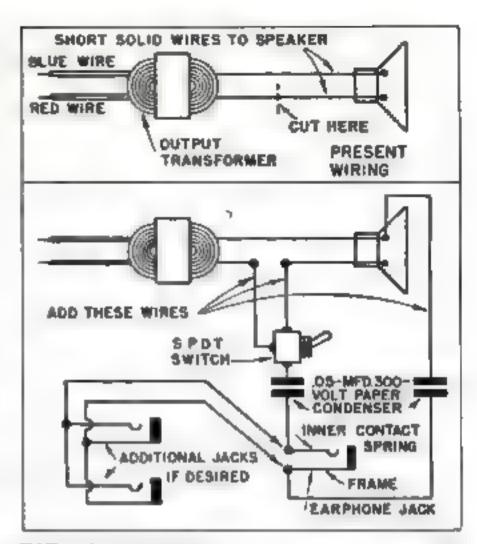
Glow Shows TV Misalignment

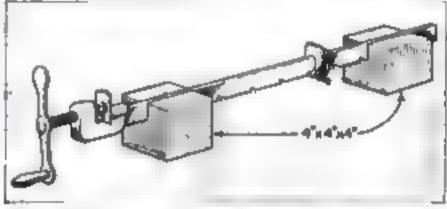
EVERYONE who has serviced or adjusted TV receivers knows the importance—and the difficulty—of aligning the ion-trap magnet. Misalignment cuts down picture brightness, fuzzes the focus, shortens picture-tube life.

The ion-trap magnet, which fits around the neck of the tube, bends the electron beam so that it can pass through a small aperture in a metal disk (see arrow). With ordinary tubes it is difficult to know when the magnet is properly adjusted. Now a new indicator ion trap, used in tubes made by the Rauland Corporation, Chicago, gives positive indication of ahgument. A fluorescent coating on the disk does the job. When the electron beam is improperly adjusted, it has the coating and causes it to glow. The ion trap is adjusted by moving the magnet until the glow disappears.

Synthetic Beef

A New food, made from dried skim milk and yeast has been developed by researchers at the University of Arkansas. Golden brown in color, it has taste and texture similar to beef but costs one third less.





Blocks Support Bar Clamps

Gluing up lumber is easy—if you have four hands. But if you have only the normal number you've probably had trouble trying to manage the work and the clamps at the same time. One way of simplifying the job is by making supporting blocks for your bar clamps. For each clamp slot a pair of 4" hardwood cubes as shown. They will hold the clamps steady while you line up the work before tightening up on the screws.—C. R Schlegel, Jenkintown, Pa.

Shop Use for Old Calendars

Don't throw away your old wall-calendars. Shop bins, drawers, and jars containing nails or screws, bolts or nuts, and other small parts can be neatly marked for size with the numbers cut from a few old calendars. Glue the numbers to the face of the container and coat with clear varnish. Calendars showing the current month in big figures and the past and coming months in small figures are fine where fractional and whole numbers are used together. You also can use cutout letter to form word labels.—Warren W. Howe, Longview, Wash.

Hardwood Dowels Make Good Handles for Shop Drawers

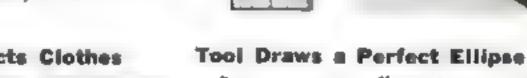
NEAT handles for shop drawers are easily made from hardwood dowels fitted with spacers of the same material.

Make the spacers two at a time by cutting them twice the required length from drawer face to handle (usually about %") plus the



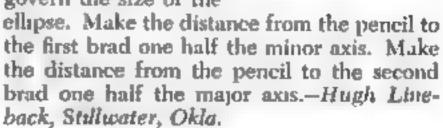
drameter of the dowel. Drill each piece through the center lengthwise, then place in a scrap-wood fig in a drill-press vise as shown. A Forstner bit or drill-press auger of the same diameter as the dowel will cut through the exact center of each piece. This yields two spacers

with one end of each shaped to fit the dowel handle. Now drill and countersink the handles at two points and screw to the drawer fronts.—Will Thomas, Buffalo, N. Y.

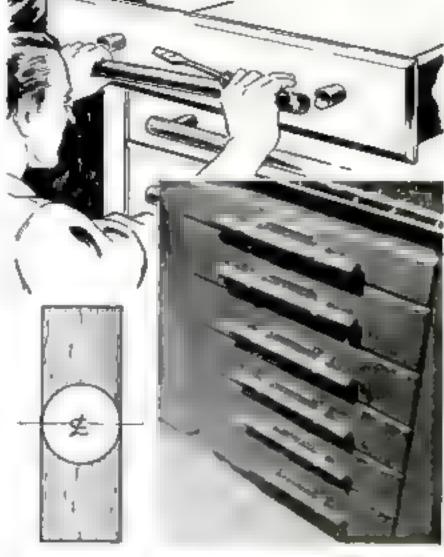


LAYING out an ellipse is easy with the tool shown in the photos below. It's a strip of wood, drilled at one end to hold a pencil, and two brads that are driven into the strip. By moving the brads against the edges of a

framing square, the pencil traces out one quarter of the ellipse. Turning the square and repeating the movement gives a perfect oval. The distances from the brads to the pencil point govern the size of the







Refrigerator Bag Protects Clothes

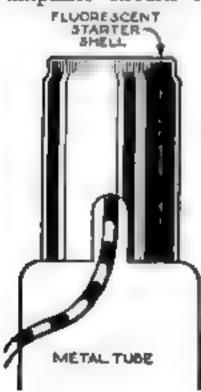
Taking a trip? Carry your shoe-polishing paraphernalia zippered up in a plastic refrigerator bag and you won't stain the clothing in your suitcase. These bags pack



shoes cleanly, too. Smaller ones are excellent for cosmetics.—Morris Williams, Troy, N.Y.

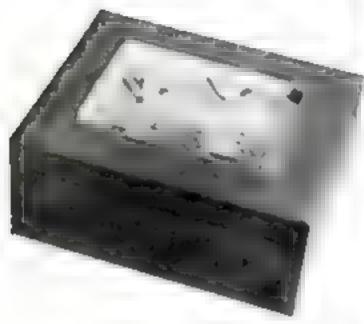
Shield for Metal-Tube Grids

Grap shields are often used in radio and amphifier circuits to reduce noise pickup.



You can make an effective shield for the type of metal tube that has an exposed grid cap on top by using the shell of a discarded fluorescent starter. The aluminum shell fits snugly on top of the tube; all you have to do is bend up the tabs that hold the shell to the base and cut out a small opening for the grid lead wire.-H. L. Davidson, Ft. Dodge, Iowa.

CRAFTSMEN AT WORK



Plastic Blends with Leather. Game birds and fish, internally carved in acrylic, are aptly framed for the sportsman's den in these leather-covered book ends and a

matching eigar humidor. The %" thick carving is backed with a thin sheet of tinted plastic. All exposed edges are beveled 45°. Made of wood, the book ends and humidor are covered with richly grained leather.

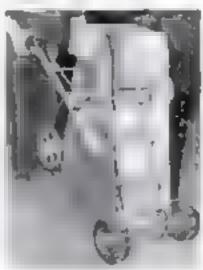
Carvings are dyed in natural colors and look like embedded miniatures of the real things. They were executed by Harry Zoback, author of the book Internal Carvings in Plastics.

Cigarette Box Hits New Note. This miniature piano puts a musical C in cigarettes. William Freeman, of Baldwin, L. I., built the baby baby grand, using walnut for the body and a thin veneer for the keys. He turned the legs from hardwood dowels and jigsawed and molded each part individually.



Power Plow Makes the Snow Fly. Light enough to be handled by a woman, the plow shown at right makes short work of cleaning a pavement or driveway. Its rear rubber wheels, chain-covered for traction, are propelled by the same motor that drives the scoops. Built by George P. Metesky, of Waterbury, Conn., it is powered by a %-hp. electric motor. If desired, a gasoline engine can be substituted. The plow weighs 75 pounds, can dig through a three-foot bank, and throws snow 15 feet.







Our new mailbox is just a dressed-up version of the old one, left. It rings a bell inside the house every time the door is opened or closed.

Mailbox Rings Bell

Why dash out in all kinds of weather to see if the postman left something? Here's a way to tell from inside.

By Karl Greif

WE NO longer have to wonder whether the mailman's been along. An antique bell on our living-room wall announces the arrival of mail. It rings twice—once when the box is opened and again when it is closed.

The bell ringer is just one of our mailbox improvements. Another is the ox-drawn covered wagon that decorates our front lawn. The wagon is built around a standard, approved mailbox. The plans on the following pages are scaled to a small-size box, but they can readily be enlarged to suit bigger boxes.

Outdoor parts: Four wheels, eight hub disks, two oxen, and the driver are cut from 3/32" aluminum. Trace the designs on heavy wrapping paper, cement them to the metal, and jigsaw the cutouts.

Make all wooden parts—such as axles, yoke, side rails, toolbox—from a hardwood that can stand exposure to the weather.

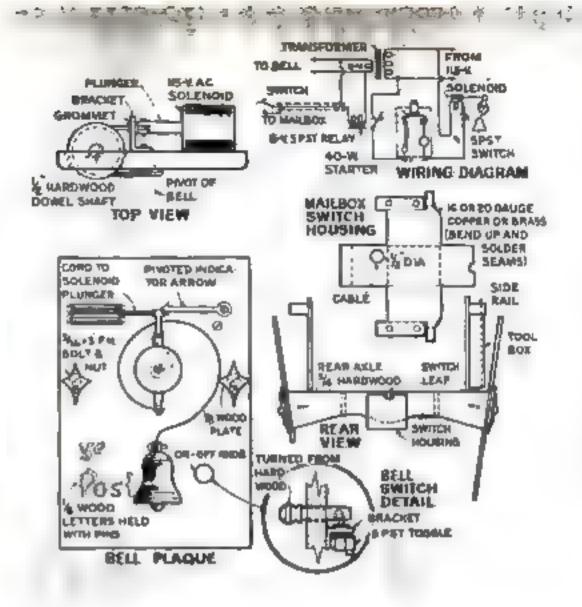
A leaf-type, normally open, midget snap switch on the mailbox actuates the signal inside. Hold the switch in the position shown in the drawings. Open and close the door, and move the switch till you find a



I designed a bell plaque to blend with our furnishings. It could be made to any pattern or even concealed in a shelf or closet.



When the solenoid, upper left, is energized, it tugs the bell. The springmounted bell jangles for a couple of seconds after the plunger drops back. A switch, lower left, turns of the power.





A hole in the wall allows surface mounting of the bell parque. Cutting that hole could be claiminated of parts on back of board were hoved in

spot where it will be actuated momenturily at some point in the door's are.

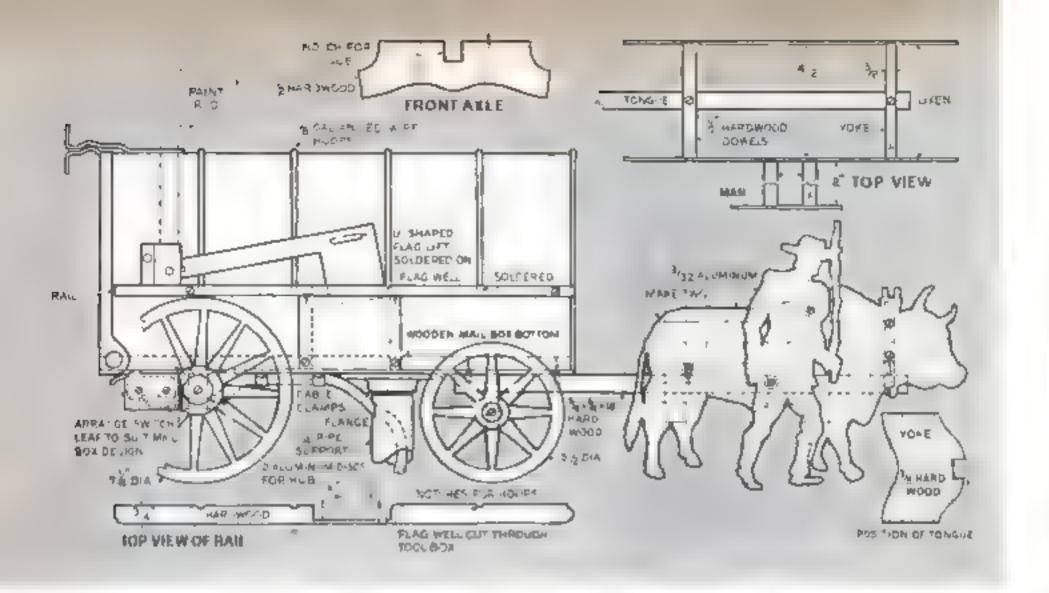
To connect the switch to the bell circuit, use a weatherproof wire such as surplus coaxial cable or a vinyl-insulated wire. A lead-sheathed cable is ideal, but it is costly and isn't needed in this low-voltage circuit. Bring the wire down through or alongside the box support and into the ground. Dig a shallow trench from the base of the support to a convenient point of entry at the house.

Indoor parts: Our bell plaque, mounting an old-fashioned doorbell, was designed to have a mildly antique look; other possibilities include using a dinner bell, cow bell, or just a concealed indicator. Since my bell must be rung by a short pulse of current, I suspended it from a coiled strip of %" spring steel so that it would keep jangling for a couple of seconds after it is yanked. To furnish the pull, I mounted a solenoid at the back of the bell plaque and connected

Relay and circuit breaker, housed in standard junction box are mounted near the doorbell transformer to keep connecting leads short

Circust breaker is a modified 40-watt, resettype fluorescent starter. The bulb made is discarded. Leads that went to it are joined.





it to the bell by waxed cord and a pulley (The solenoid I used, made by the Guardian Electric Mfg. Co., Chicago, is model No. 4, for intermittent use on 115 volts AC.) I also added a switch to keep the bell from ringing when someone is sick.

If you wish a further indication of the mailman's coming, you can pivot an indicator arrow (see drawing) so that the tip rests on the bell-pull arm. When the sole-noid pulls the arm, the arrow falls and stays down until it is reset.

Wiring for safety: The wiring dargram is a bit more complex than it has to be, but it includes a couple of worthwhile safety features. A regular two-wire cable goes from the 115-volt house line to the solenoid and switch. All the rest of the wiring is at low voltage.

Connect the wire from the mailbox to the low-voltage side of your doorbell transformer through a 6-volt, SPST, AC relay. If your bell transformer isn't conveniently located, use a separate transformer.

A time-delay cutout or circuit breaker in the solenoid circuit is another safety feature, for the solenoid will overheat if it's energized for long periods. This might happen if the switch jams or if something goes wrong with the wiring. The shut-olf is adapted from a 40-watt, cutout type of fluorescent-light starter (the kind that has a reset pushbutton on the end). Remove the starter from its aluminum shell, and short out the starting contacts. You can do this by snipping out—and discarding—the glass cartridge, and joining the two leads that went to it. Twist the two wires together and add a drop of solder to the joint

If the solenoid draws current for more than a minute and a half, the starter cutout contacts will snap open. After you have corrected the trouble, press the reset button to put the system back in operation.

Leaf of midget snap switch is actuated by the opening and closing of marlbox door. Soldered-up metal box protects switch from the weather.

Wooden yoke and wagon tongue hold oxen in position. Driver is held by dowel spacers. Supports should be made of close-grained hardwood.





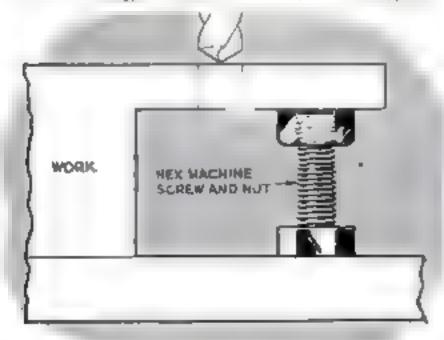


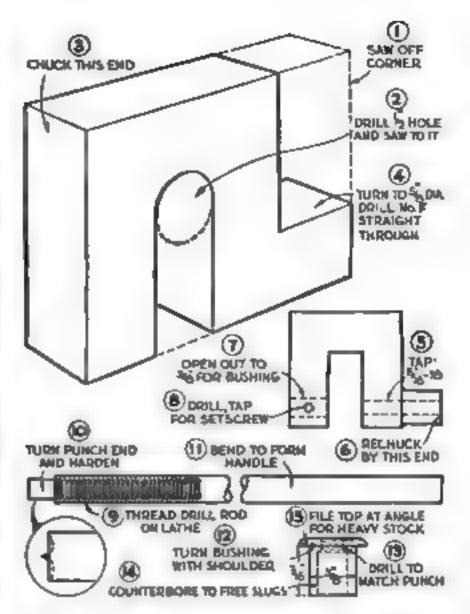
Sheet-Metal Punch Uses Screw Action.

Clamped in a vise, this punch pierces husky sheet metal at the turn of a handle. The anvil and the threaded punch are removable, so several can be made up for different holes.

The body, sawed from %" steel, can be chucked off center in the four-jaw, or gripped between two jaws of a universal chuck, as shown in the photo, with a block under the third faw.

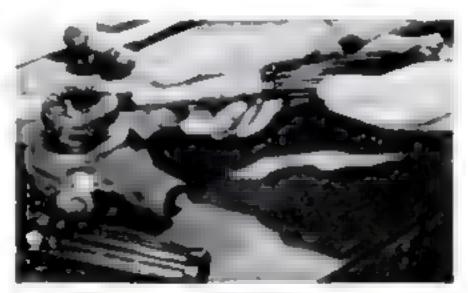
Bolt Acts as Jack Screw. When a shorter than standard jack screw is called for, an ordinary machine screw and nut may serve the purpose, as shown below. Cut the screw to length, face the head square in the lathe, and put the nut on upside down. Back the nut off to tighten.—H. Seveik, Los Angeles.





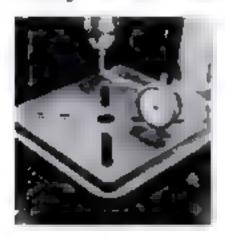
A square end will serve on the punch, but the pointed, hollow-turned one shown in the drawings cuts more cleanly. The point also makes it possible to locate holes accurately on a punch mark.

For punching heavy stock, file the top of the anvil bushing at an angle to get a shearing action. Harden both the anvil and the punch end; then draw to a light straw color. —Floyd McGuckin, Ridgewood, N. I.



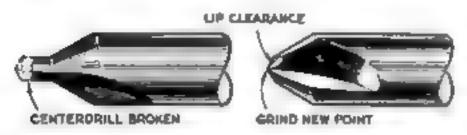
Grip Improves Die Stock. A bicycle handle-bar grip, shown above, makes the pipe handle commonly used on ratchet-type die stocks easier on the hands. It also prevents marring of walls or other surfaces if the handle strikes them. Should the grip fit loosely, wrap friction tape around the handle first. Pad the end with a bit of waste or rag to keep it from cutting into the rubber. —Walter E. Burton, Akron, Ohio.

Squaring Drill-Press Table. A table that isn't exactly square with the spindle of a drill press can cause a lot of grief. If you



have a dial indicator, you can check yours quickly, as shown at left. Thread one end of a steel rod, bend it to a right angle near one end, and mount the indicator with a couple of nuts. Chuck the short end firmly.

Moving the indicator cautiously around the table will provide test readings. To test the base table, use a longer rod.—Will Thomas, Buffalo, N. Y.



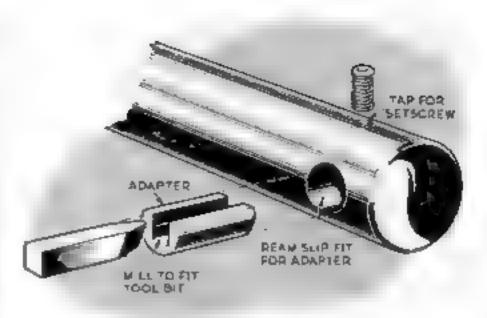
Centerdrills Salvaged. Instead of throwing away broken centerdrills, regrind them, as above, to a new point, with clearance back of cutting lips. Although no longer good for making center holes, they are handy as starting drills on lathe or drill press, and less likely to break than a good centerdrill.—

Henry Sevcik, Los Angeles.

Clamps Double as Parallels. Hex nuts give these rugged clamps a tighter grip than ordinary ones—and, because the screws are on one side only, the lower jaws serve as parallels. Thus work can be clamped together and set up on a machine table without extra pieces. Four clamps take care of most jobs.

A %" by %" by 3" piece of hardenable steel is required for each jaw. The %" dimension of all the lower jaws should be held

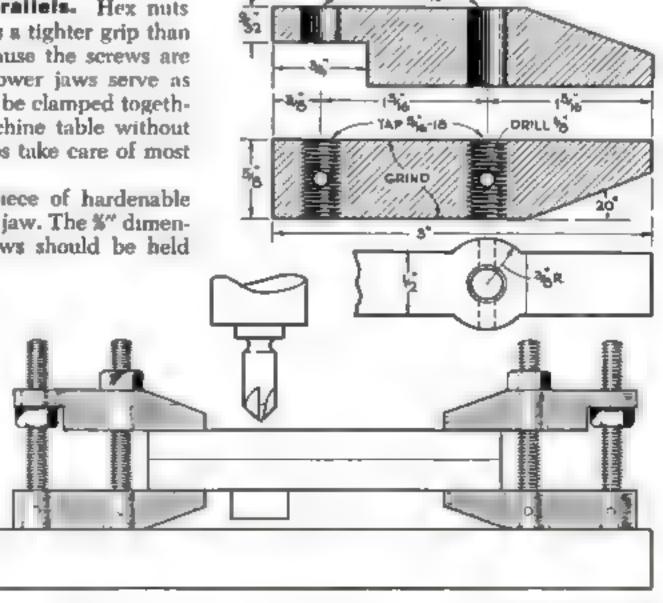
to a close tolerance, preferably by surface grinding. Drill across the threaded holes for pins cut from %" brazing rod to anchor the 3" long screws, which can be made of drill rod. Thread them 5/16"-18 all the way. Harden and temper all parts before assembly. - Jesse R. Lucas, Michigan City, Ind.



Adapter Squares Round Holes. Hand filing square holes in boring bars is a tedious
job. The simple dodge shown above not only
saves a lot of work, but eliminates all need
for scrapping a bar just because tool-lit
holes are worn. Mill a piece of drill rod to fit
the bits. Then drill a round hole in the bar
and ream it to a slip fit for the adapter. Drill
and tap a cross hole for a headless setscrew,
which holds both bit and adapter.—Irving
Mansfield, New York.

Color Spots Tapped Holes. In tapping blind holes, it's often necessary to use both starting and bottoming taps. If white lead is used to lubricate the starting tap and red lead for the other, holes are readily identified.—Harold Htatt, Michigan City, Ind.

DRILL 46



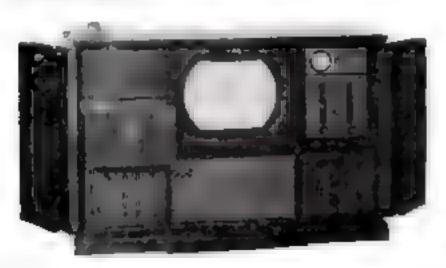
Glass Panel Protects Kitchen Wall



A SPLASH panel of structural glass is one answer to that problem area behind the stove. Easily kept clean with a damp cloth, it protects the kitchen wall from grease, grime, and heat. The 44- by 28-inch panel is set into the wall pluster in homes under construction. In existing homes, the householder determines the stud positions before ordering, and the glass is drilled to order. Decorative screws mount it to the wall. The Pittsburgh Plate Glass Co., Pittsburgh, Pa., makes the panels in many colors, including white, ivory, green, and blue.

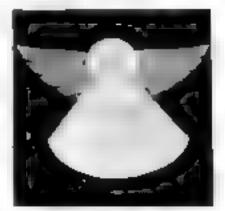
This TV Set Even Listens for You

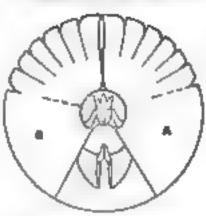
IF THE music box below doesn't entertain you one way, it will another. It's Du Mont's "Westminster"—a combination of a 19-inch television receiver, an AM and an FM radio, a three-speed record changer, and an automatic, twin-track tape recorder that makes possible one hour's playback. The recorder picks up from its own microphone or off any of the other services and can be played back immediately. There's also a clock to turn any part of the combination on or off at preselected times.



Make Paper Angels for Christmas

You don't have to be an artist to make the complacent little angel shown at right. And it's so easy to make you can quickly snip out several to serve as place cards at Christmas parties. Draw the design on heavy white drawing paper and fint with pastel colors. Cut out the circle and cut in on the dotted lines as shown in diagram. Slide wing slot A into slot B. Bend the wings forward un-



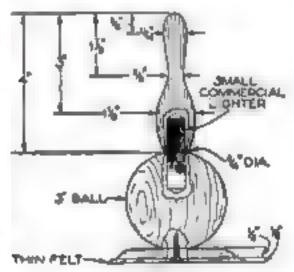


til the figure stands firmly with wings close to the body. Silver or gold foil can be pasted on to add glitter.—Hons Schmidbauer, Augsburg, Germany

Use Same Brand of Motor Oil in Car

Use whatever motor oil you like in your car-but stick to the same brand. It's a good idea not to mix brands, for they may contain different additives that will work in opposition to each other. Additives are used to give various desirable characteristics to oil.

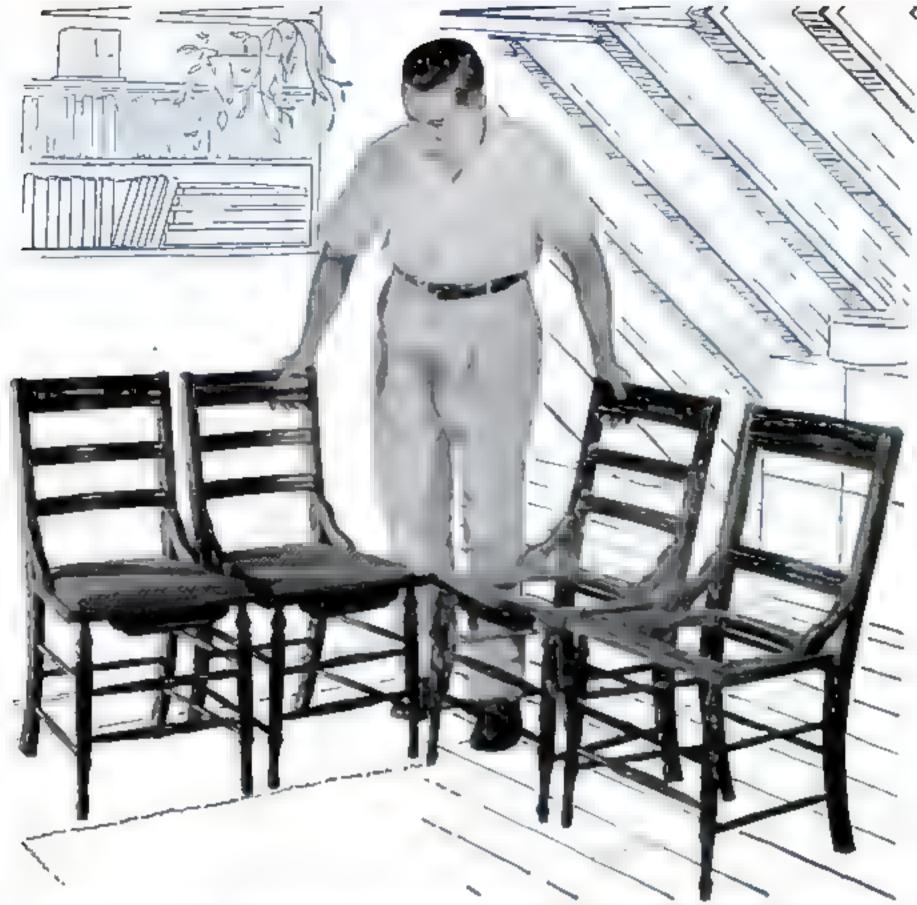




Cigarette Lighter Designed for Bowlers

This lathe-turned cigarette lighter will delight a bowling fan. Inscribed about the base, it makes a fine trophy. Turn the wooden parts from any hardwood. (I made the base and ball from maple, and the pin from mahogany.) Flatten the ball slightly at opposite ends so that base and pin fit neatly.

Drill the ball and pin to give the lighter a tight fit in each. If desired, the base may be routed out and filled with lead shot so it will also serve as a paperweight. Finish with clear lacquer or shellac.—Anthony M. De-Nardo, Brooklyn, N. Y.



Before refinishing, the pair of handsome chairs at left looked like the two at right.

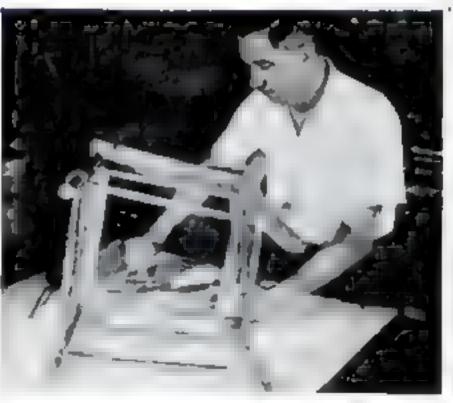
Treasure Hunting in Your Attic

That's where these chairs came from and rejuvenating such cast-off furniture as this is a challenging pastime.

By Denis Sneigr

NOT even the junkman would take the four old chairs. Besides showing the scars of decades of use, they had taken a beating in a flood. The joints were loose, back center rails were missing from two of them, and what was left of the finish was

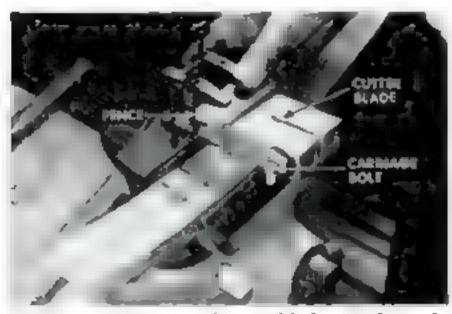
Taken completely apart, the chairs had the old finish stripped off with paint remover. All parts were sanded smooth and clean.



DECEMBER 1950 219



Missing back center rails were duplicated with homemade scratch stock. Cutter of scratch stock is being filed to shape (left).



View of underwide of assembled scratch stock. Cutter is locked in slotted block by clamping action of tightened carriage bolt.



Scratch stock is used by pulling or pushing it along work while fence is held tightly against one edge of work. Cutter curves molding



Chairs were glued up after replacement parts were made. Doweled seat frame is being fitted here. Twisted rope can sub for clamps.

scaling and mottled. The old seats were missing from all the chairs, too.

Piled in a corner of the attic and covered with dust and cobwebs, they looked pretty terrible. But I thought I'd see what I could do with them. The results were impressive. A \$25 outlay for materials, plus several evenings' work, turned out four handsome, ladder-back side chairs

First step was to take the chairs completely apart. Every joint needed new glue anyhow. And it was easier to work with the individual rungs, legs, and rails while taking off the old finish with paint remover.

After the old finish was removed—and that wasn't hard because of its bad condition—all the pieces were sanded smooth.

Duplication of the missing back center rails came next. These are the curved pieces across the back of the chair. Using one of the old rails, a pattern was laid out and the new rails cut out on a bandsaw. (If you don't have a bandsaw, a carpenter shop will do this sort of job for you.)

Making a Cutter

The molding on the rails was reproduced with a senitch stock having a cutter made from an old file. A chisel or saw blade could have been used. To make such a tool, you heat the metal—on the kitchen stove if necessary—until it turns dull red, then let it cool slowly out of drafts. This softens the metal so you can shape it with a file or grind-stone

Shaping it to match the old molding is just a case of trial and error. File or grind the metal until your cutter fits snugly in the molding you want to duplicate.

Just to be sure, you can make a few trial cuts with the tool before you re-harden and temper it. Then take it back to the stove, heat it to a cherry red, and plunge it into a can of salt water—about a tablespoon of salt to a pint. This treatment re-hardens the metal. In fact, it makes it so hard that it is brittle. In this condition, thin parts of the cutter might break in use. Before you temper it, rub the cutter with emery cloth to bring back the brightness of the metal

This time heat the cutter cautiously until the edge turns a straw color. Be careful not to overheat it: fan it back and forth through the flame. The moment the straw color reaches the edge, dip it again into the salt water. Then you're ready to mount the cutter in a scratch stock.

The chairs were reassembled with glue



Paper pattern was made from new plywood seat base and laid out on the cloth. Allowance was made for material to lap under sent.



Half inch of foam rubber was cemented to plywood seat and brocaded rep tacked in place. Corner is being mitered in photo above.

and clamps. While the glue was setting, the new seats were made. These were %" plywood cut to fit, with %" sponge rubber for padding and a covering of brocaded rep (an upholstery fabric). Four screws from underneath the seat rails hold the new seats in place.

How They Were Finished

Before the new seats were fastened, the chairs were finished. Of course, there are a variety of finishes you can use when refinishing old furniture (PS. Aug. '50, p. 158), depending upon the kind of wood. These old chairs were made of maple. In some of the pieces the grain wasn't good looking, so they were given a finish that concealed almost all the grain. In finishing these chairs, each one was:

Sprayed with penetrating walnut stain:

 Given an alcohol rubdown to remove spray dust and to bring out some grain highlights;

Sprayed with lacquer sealer;

Wet-sanded with No. 400 paper;

Rubbed with No. 00 steel wool.

Sprayed with lacquer sealer; and

Tape Protects Jigsaw Patterns

Commercial serolls aw patterns are printed on flimsy paper since they are intended to be glued to the wood and used only once. When I want to use the same pattern several times, I cover the lines with cellulose tape and transfer the design with carbon paper. The first time I use the pattern I trace the lines very carefully. The small track that is formed in the tape makes it easy to follow the lines in subsequent tracings.—H. Chatilion, San Francisco



When new finish was dey, new seats were anchored in place with four flat-headed wood serews driven into plywood from under seat rails.

 Sprayed lightly with clear lacquer thinner while still wet from the second coat of lacquer sealer.

The lacquer thinner acts as a surface solvent, dissolving spray dust from the lacquer sealer and toning the surface to an even gloss.

Salvaging Nail-Polish Brushes

THE better grades of nail polish are sold with very fine applicator brushes. When the bottles are empty, you can salvage the brushes. Cleaned with polish remover or lacquer thinner, cut free of the bottle cap, and fitted securely to a wooden handle, they make excellent paint brushes for children. Save some for use in the shop; they are also fine for dusting or painting models or delicate optical and electrical instruments.—Kenneth Murray, Colon, Mich.

Clamps Make Sawing Safer

The blade of a circular saw is all right in its place. One of the places where it isn't all right is too close to your fingers. The photos below are reminders of three easy and safe ways to handle ticklish jobs.—

Louis Hochman, Sherman Oaks, Calif.



Cross cutting large work can be handled on small saw by clamping guide strip to undernde of work. Guide strip rides against side of saw table as work is fed through saw.



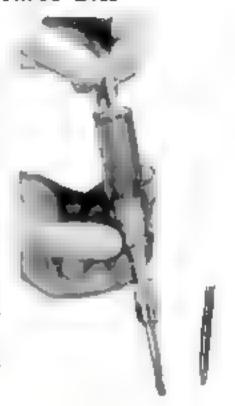
End grooving (left) can be done safely this way. Work is clamped to strip that slides along the top of fence as work is pushed into blade. Pusher stick holds work against fence.

Edge grooving small pieces (below) is done safely when strip is clamped to fence. Pusher sticks keep fingers away from blade. Work should fit snugly between table and strip.

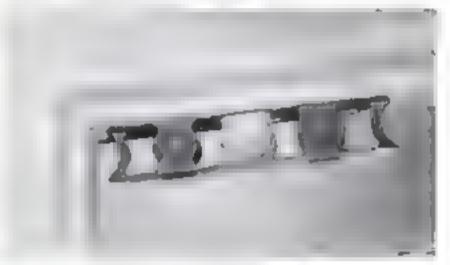


Screwdriver Holds Three Bits

This magazineloading screwdriver drops another bit into place for use as you remove one from the chuck. The bit you remove then is reloaded into the handle. as shown at right. The three bit sizes are 3/16" flat, 9/32" flat, and No. 2 Phillips. Selecto Products Company, of Cleveland, Ohio, prices the tool at \$1.50.



Level Sticks to the Job



PERMANENT magnets in the case of this level hold it to any ferrous-metal surface, leaving both your hands free for the job. Instead of the usual bubble, this level has a dial that registers from 0° to 360°. The tool, priced at about \$6 by the Buckeye Plastic Corporation, Cleveland, Ohio, sticks to round or flat surfaces.

Tool Tightens Floor Boards

PULLING the lever of this tool forces tengue-and-groove floor boards tightly together for nailing. Eighteen spikes on the underside bite into the subflooring to give you a firm grip. The tool—with the proper facing insert—also can be used for laying

roof boards, parquette flooring, putting up shiplap and other siding, bracing joists, stretching acreening, and planking and decking boats. It's priced at \$6.75 by R. M. Products, of Rochester, Mich.



Drilling News



Radial Drill Press Tilts on Column

This flexible drill press, manufactured in Melbourne, Australia, can be swung to convenient positions for angle drilling. The horizontal column has a graduated collar on it for correctly setting the angle.

Drills Inserted in Shank



Inserts from 9/16" to 2%" in diameter—like those shown at left—can be locked in shanks from 3" to 24" in length to give you a variety of drills for wood or metal. Any insert fits any length shank. Shanks are %" in diameter except a 3" shank that is turned to %" on one end for use in %" electric hand drills.

The producer, W. W. Williams Industries, of Athol,

Mass., also makes routers and shapers that are locked in a shank for use in a drill press or portable router. Prices range from 90 cents to \$5.

Bit Resharpened with File

One of the features of a new auger bit (below) is that it can easily be resharpened with a flat file or grinding wheel. It comes in 14 sizes from %" to 1%". Prices run from 70 cents to \$1.55. The maker, Whitman & Barnes, Plymouth, Mich., says it drills 25 percent faster than standard bits.





THE attachment pictured here makes it possible for any X" electric drill to bore up to a %" hole. Reduction gears in the unit reduce the speed to a fifth of the normal speed, greatly increasing the torque delivered to the %" chuck. In operation. the K" knurled shank on the attachment is chucked in the drill. Attachment and drill

are then operated as an ordinary electric drill. The maker, G. M. Co. Manufacturing, Inc., New York City, prices the attachment at \$12.50.

Gears Give You Two Speeds

By using low speed you can safely drill large holes in wood or steel with the drill shown below. With a full load the drill's speeds are 275 r.p.m. and 550 r.p.m. Capacity in steel is %" at low speed and %" at high speed. Capacity in hardwood is 1%" at low speed and %" at high speed.

Other features of the tool, made by the Louisville Electric Mfg. Co., Inc. of Louisville, Ky., include a universal motor available for 32, 110, or 220 volts and an adjustable rocker ring for correct setting of the brushes. The price is \$105.





Ice Cubes Lick Christmas Cards for You

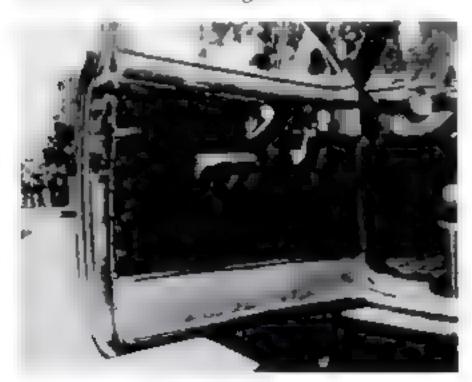
If rt's your tongue that takes the licking when you have a stack of Christmas cards to stamp and seal, try using ice cubes instead. As they melt, you'll always have a wet surface ready for moistening stamps or flaps.—Mary Fulker, Monument, Colo.

Plastic Hides Worn Car-Door Fabric



WHEN the fabric on your car door becomes torn or badly worn, the easiest repair is to cover it up. You can do this with a product called "Cov-Ra-Door," a piece of sheet plas-

by clips and the door and held in place by clips and the door handles. Made by A. N. McCreight, of DuBois, Pa., the covers are sold for about \$4.50 a set and come in a selection of ten colors. The same company also makes clear plastic covers that protect the original fabric on new cars and allow it to show through.



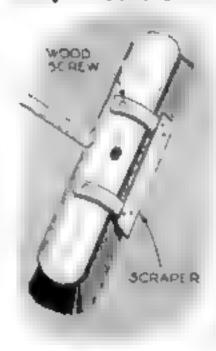
Ball Bearings Will Mix Paint in Can

HERE is a quick and easy way to stir paints used frequently in small amounts. After the can is opened and the paint thoroughly mixed, drop a dozen or more steel balls from a discarded bearing into the can.



To get a smooth mix thereafter, just shake the can vigorously before you paint.

Shop Broom Carries a Scraper



A PUSH broom will do double duty around garage or shop if a scraper made from 3" by 1" strap iron is attached. Center the scraper on the broom and fasten with wood screws. It should be changed to the opposite side when the handle is changed.—

J. Lucas and H. Hiatt, Michigan City, Ind.

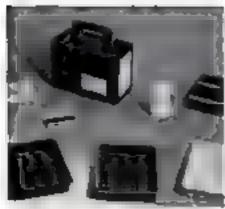
Small Glue Packets Save Time

For those quick jobs where it's not convenient to get out the glue pot, U.S. Plywood Corp., of New York City, now puts up its Weldwood powdered resin glue in small measured packets. Each unit has three tear-off sections, the contents of which, mixed with half a teaspoon of water, provide enough glue for the average small fix-it job around the house. Proper consistency is easy to get without waste.

Coffee Makes a Clean Sweep on Floor

Confronted with a basement cleaning job and having no sweeping compound, I salwaged the morning's still-moist coffee grounds. Spread on the floor, they held down dust and freshened the air with a mild coffee aroma.—
Edwards Rogers, Columbus, Ohio.





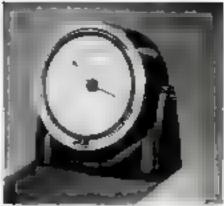
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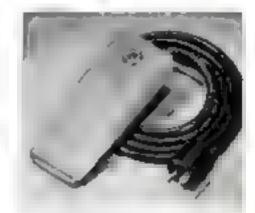
Kedak Timer—tilting base, sweep second hand, large, easily legible dial - \$6.75



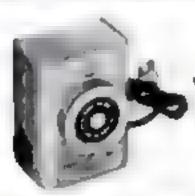
Kodok Hebbylst and Flurelite Enlargers—coal fluorescent lamp, "Integrating-sphere" tamphouse. Hobbylst (left)—549.50 camplete, Fluralite (right)—\$112.30 without lens,



Kodek Actomatic Tray 51phon-converts tray to afficleat print washer-\$5.25

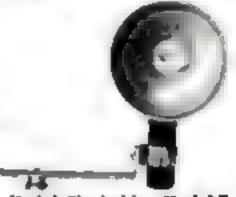


Kodek Utility Feetswitch-frees both hands for handling equipment and materials-\$10



Kadak Blactric Time-Controlautomatically controls printing time, 1 to 57 seconds—\$13.50

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Gus Fixes the Local Scrooge

[Continued from page 176]

the obvious things, including the great Mr. P's pocketbook." Gus admitted. "But there's an off chance that the carburetor could be the culprit."

With that the veteran mechanic slid in behind the wheel, turned the ignition key, and pushed the starter button. The engine ticked off immediately. Then Gus tramped down hard on the gas pedal, pushing it down to the floorboards. The engine took it without a balk or a splutter. Next, he idled it down and let it run awhile There wasn't the slightest sign of a roll or a gallop or of choking up.

Could It Be Ignition?

"Well, there's one good hunch shot," he said as he got out of the car. "Might have known it wouldn't be that simple."

"What next?" Stan asked.

"I've a feeling it's probably some quirk in the ignition system, since the carburetor seems to be okay. Bring over the tester and we'll start by checking the new parts that the boys over in Evansville put in."

Methodically Gus went over the coil, the condenser, and checked the timing. He inspected the distributor. Everything seemed

as it should be.

"Guesa this isn't my day for hunches," Gus admitted shaking his head. "I'll check the starter and if that isn't it I guess the best thing we can do is just let 'er sit for a couple of hours. Then we'll watch for symptoms when we try to start 'er again,"

Stan watched as Gus operated the starter, using the solenoid under the hood. A faint smile began to spread over Gus's mouth.

"Something wrong with the starter?"

Or Is the Starter the Clue?

Gus shook his head. "No. but come over here and see if you hear the same thing I do. Stick your head down under the hood there while I run the starter."

Stan did as directed and Gus pushed the

starter button.

"Hear anything?" Gus asked.

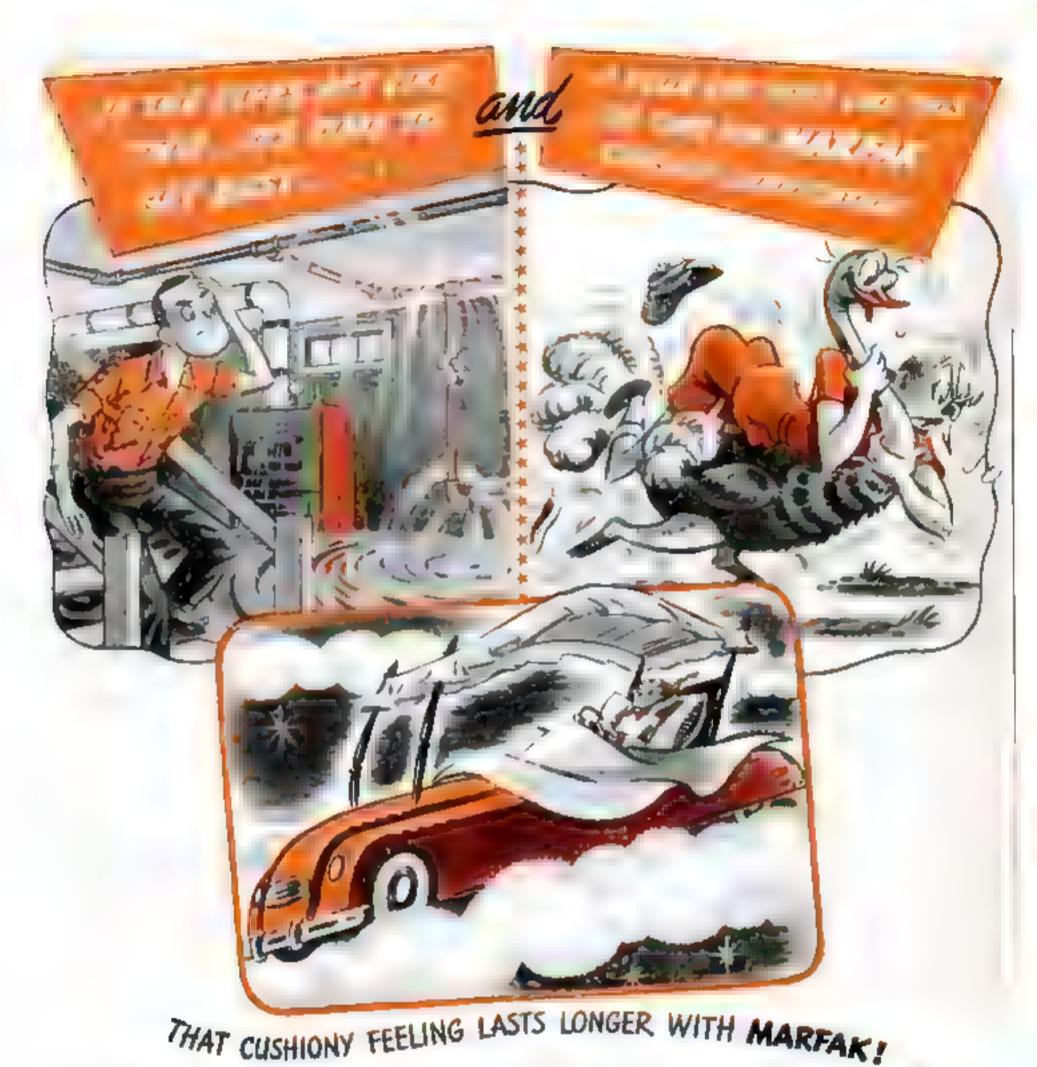
"Yeah, sortuva bubbling sound, like

water," Stan agreed.

Gus walked around to the front of the car and unscrewed the radiator cap. "Now, hit that starter button again."

As the starter ground, Gus watched. "Okay, cut it," Gus called after a few

[Continued on page 230]



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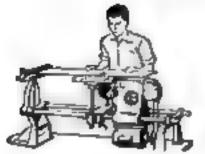
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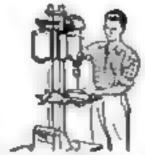
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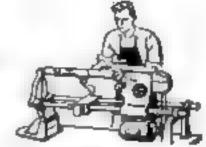
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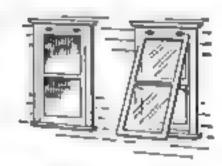
TOYS



POTEST PROFESTIVE



GAMES



HOME IMPROVEMENTS

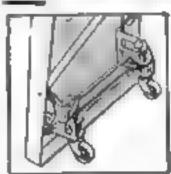
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Gus Fixes the Local Scrooge

[Continued from page 226]

seconds. "Seems to be an awful lot of circulation in that radiator-more than most water pumps can put out. Let's try something."

Loosening the generator bracket, he

slipped the fan belt off.

"Now hit that starter button once again," Gus directed as he peered down into the radiator filler opening again. water circulation even when the pump is disconnected," he called signaling for Stan to take his finger off the starter button. "Now we're getting someplace."

Cracks in the Head Gasket

"What does that show," Stan asked, "a

leaky head gasket?"

"It does unless my third hunch is wrong," Gus agreed. "Here, give me a hand getting this head off."

After they had lifted the head off and placed it on the bench. Gus pointed to small crucks in the head gasket and signs of water seepage into four of the cylinders.

"There's our trouble." Gus pointed to small droplets of water. "Put in a new head gasket, Stan, and I think Mr. Purcell's hard-starting troubles will be over."

"Gus," Stan said as he tightened the last of the cylinder-head bolts, "I still don't see how water leaking into the cylinders could have caused the trouble. And if it did, why didn't it show up in other ways?"

"That's my fourth hunch for the day," Gus admitted with a grin, "but I'm more than sure of this one. I reckon it this way. There wasn't enough of a gasket leak there to cause compression loss, but there was enough of a leak to allow a little bit of water to seep into those four cylinders when the engine hadn't been run for two or three hours. Every time Purcell tried to start his engine under those conditions, the little water in each cylinder would foul the plugs."

Stan Gets the Answer

"But what about it starting when he got

someone to push him?"

"After several blocks of pushing, the cylinders were able to clear themselves," Gus explained. "Then the engine would eatch.

"On the other hand," he continued, "while the engine was still hot, any water

[Continued on page 232]



Dear Folks:

You can save yourself some dough and maybe get out from under a big repair bill if you'll drive right down to your motor specialist and mak to see his Danger Zone

This book takes all the eystery out Book. of car repairs shows what the parts look like, what they cost, what the charge for installing them will be And-most important -the book shows what you can mave by having repairs done when first needed.

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Engine leses pep . . .

BANGER ARME

Engine begins to smoke . . .

DANGER ZONE ?

Engine pumps all hadly

DANGER ZONE 1

Destructive wear sets in . . .













Needs a tarne-up

Clean, adjust and re-time ignition. Grean fuel supply and carburetor screens. Adjust carburator, Adjust tappets and fan beit Check compression and vacuum readings for symptoms of ring weer.

Needs now pistum rings ____

Replace piston rings, Augn rods Adjustrodsorreplace rod bearings. Reseat and reface valves.

Tune engine.

These repairs are comparelively inexpensive and put the origine back in peak cond tion for thousands of economical miles. Delay puts the engine in Danger Zone 2.

Needs now platen rings and major angine repairs.

Replace piston rings, Replace piston pins. Adjustprobably replace—main bearings. Aign rods. Adjust rods or replace rod bearings. Reseat and reface valves. Tune engine.

These repairs naturally cost more than those needed in Danger Zone 1. but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

Needs now piston rings and complete everheel

Repairs cost three or four times as much as **in** Danger Zone 1.

Remove angina.Rebore cylinders. Replace pistons, pins, rings. Replace main bearings, Aign rods refit or replace rods, or replace rod bearings. Overhaul. valve lifters, rocker arms. Replace timing chains of gears. Reseat, reface valves. Replace guides and springs. Replace camshaft bearings. Clean on tines. Overheal oil pump

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TOUGH on OH Pumping . GENTLE on Cylinder Walls

GET YOUR CAR DUT OF THE

THE MORE TOU DELAY THE MORE YOU PAT!

Gus Fixes the Local Scrooge [Continued from page 230]

that seeped in would vaporize. Then there'd be no shorting out of plugs and the engine would start with the starter."

Gus was busy on another job when Purcell walked into the repair shop at about five-fifteen

"Got my car ready?" he boomed.

"Right over there," said Gus, pointing with a wrench.

"Fix it?" asked the big man as the two walked across the garage.

"Well, I think your starting troubles are over, Mr. Purcell."

Purcell slid behind the wheel. "Sure you fixed it now?" he asked suspiciously.

"Try her yourself. She's been sitting here cold for more than three hours."

Purcell grunted and pressed his foot on the starter. The engine caught immediately. "That's more like it," he said, almost pleasantly. Then he soured up again. "What're the damages?"

"Twenty-five dollars," said Gus. "And if it isn't really fixed, bring it back."

The Big Shot Balks but Pays

Purcell, pulling a roll of bills out of his pocket and peeling off two tens and a five. "But if you've fixed it for good, I guess it's worth it.

"And here's that bonus I promised," he added, reluctantly peeling off another ten and handing it to Gus.

As Purcell's car disappeared down the highway, Stan said, "You did two things just now I've never seen you do beforeovercharge and accept a tip. How come?"

In reply, Gus handed Stan the letter he'd been reading earlier in the afternoon. Then he said, "Purcell doesn't know it, but he's just made his first contribution to charity."

Stan looked at the letter. It was a Christmas appeal from the local orphans' home asking for money to help pay off the mortgage.

And guess who holds that mortgage?" Gus asked with a wink.

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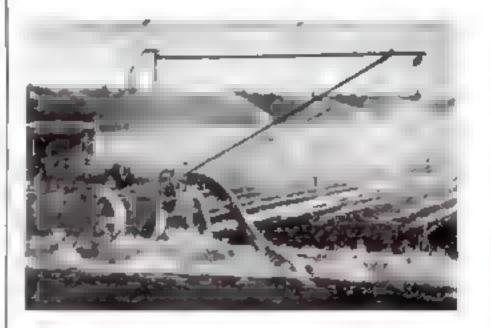
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Mechanics of Farming



By Ladd Haystead

- Two arms like shears, pivoted in the middle, a spring to hold the jaws closed, a cow's tail between pads on the jaws, and you have a mechanical solution to one of the world's oldest problems--keeping a cow's tail from batting the milker in the face. It's patented.
- The use of thyroprotein in dairying, reported in this column last spring, is questioned by the Ralston Purina Co., famed makers of cow feeds. The cow's heartbeat and the rate of breathing is increased as much as 25 percent, says Ralston: "Until further experimental work is done . . . the dairyman who decides to feed thyroprotein is taking quite a gamble."
- mews of the installation of portable irrigation systems. Once used only on arid land, the technique is now being tried in humid areas, eince rain, while it may be plentiful on an annual basis, is very likely to come at the wrong time or not at all when a crop needs it. The illustration shows an International Harvester U-6 power unit, mounted on a steel wagon, at work south of Lake Okeachobee, Florida, on a drained muck-land farm. It is providing overhead irrigation for newly planted



celery through 5-inch portable pipe placed in rows 600 to 1,200 feet long.

■ "Systemic entomology" is another new farm word from Texas. It means

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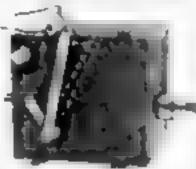
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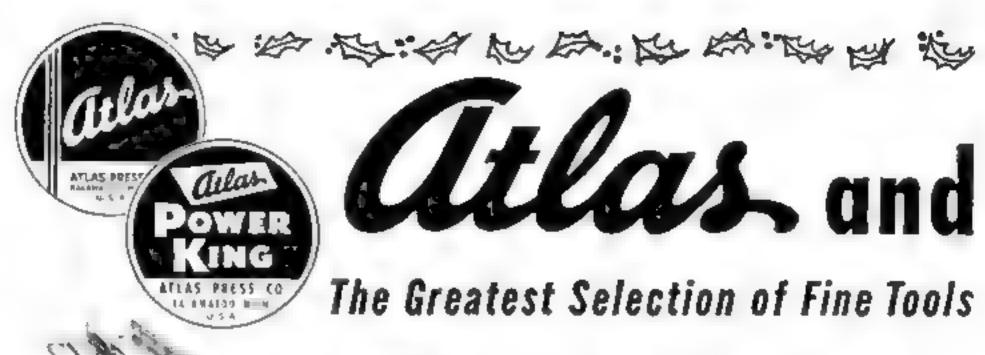
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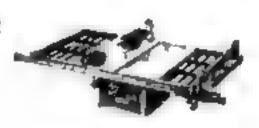
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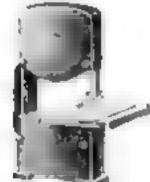


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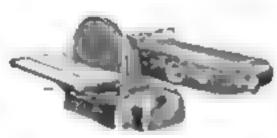
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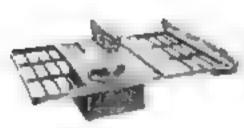
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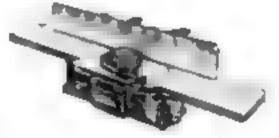
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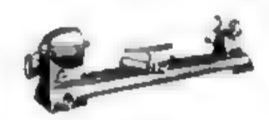
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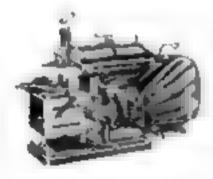
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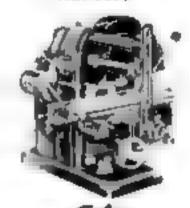
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Mechanics of Farming

putting poisons for killing plant pests in the soil at time of planting. The poison is taken up by the plant, killing the bug that strives to get a meal from the plant. Octabethyl pyrophosphoramide has shown good promise when as little as one-fifth pound to the acre was applied at cottonseed-planting time. It took care of aphids and red-spider mites for two months.

- The University of Illinois comes up with a cure for chicken-eating hogs: lay a chicken carcass on a board, hook one wire from an electric fence controller to the carcass and ground the other wire--and then invite the hog to try it.
- Pellet range seeding has not lived up to its widely publicized promise, according to Donald M. Barnard, University of Wyoming, Airplane-sown pellets have not penetrated the range soil: rodents still eat them; germination has been lowered by some of the processes used: and satisfactory stands of range grasses have not been obtained. At least 150,000 acres in five states have been seeded but the results were unsatisfactory, the investigator says. Comment: This reporter. some readers may remember, was one of the publicists who started the "widely publicized promise" in another national magazine, but he stated what the experimenters would try to do, did not "promise" results.
- Sooner or later someone was bound to come up with the term "atomic farmer. " University of Chicago was first under the wire in announcing a Ph.D. would be awarded to Aaron Ganz, Atomic Energy Commission fellow, for his work in growing tobacco plants successfully in air containing radioactive carbon dioxide. nicotine was extracted from the plants and injected into the bodies of animals. This made it possible to trace what happens to nicotine in the body. Nicotine is gotten rid of through urine, but none is given off through the lungs. Nicotine has long been known to have a peculiar affinity for the heart, but Ganz's experiments indicate there may be some means by which the heart can protect itself against the effect of nicotine.

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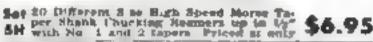
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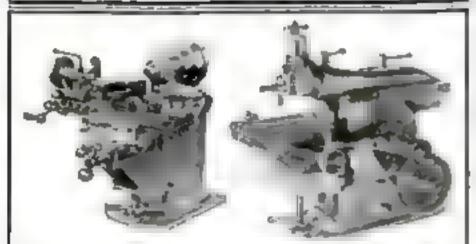
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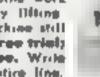
We supply the castings. Our machines especially designed for individual construction Our catalogue with complete drawings of this Bench Milling Machine or Six Inch Stroke Shaper 25 cents per set postpeid For full information send One Doi ar for 20 sheets quarter and half ful size complete construction drawings of three Millers, Shaper and Bench Lathe, accessories and attachments. Refund on castings order

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Send 25c in only for Burr's Blue Book of saw shop charges and other valuable information.

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MACHINE SAW FILING PAYS UP to \$2 or \$3 an HOUR

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You can work in your basement or garage—no experience necessary. "The first saw I sharp-ened with my Foley Filer came out 100%"—writes Clurence E. Parsons. No canvassing—"I advertised in our local paper and got in 9) saws"—says M. L. Thompson. The Poley is the only machine with which you can file all hand saws, also hand saws and cross-cut circular saws.

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Shows how you can get business from house owners farmers, carpenters, schools, factories, etc. With a small investment, no overhead, no stock of goods to carry you can get right into a cash business, and possibly later on develop into a full-time repair shop. Send coupon today for Free Book. No salesman will call

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sales in my sp. ro
time in the 4 y "Each new I filed got me vismare and bust the do fit and the pre al, com-ing back Lan ness has been picking up that way since a year ago. If it Mare fitted uver 2 Jun saint in 18 months One costomer al keeps up I wid have to buy another Foley Baw Filer " Williams mandher k G Baldwin

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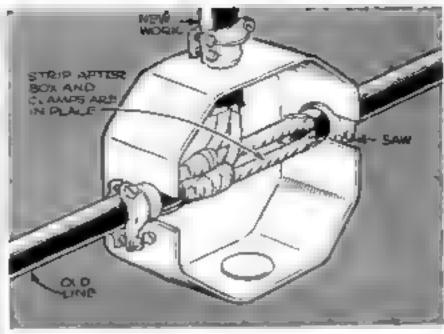
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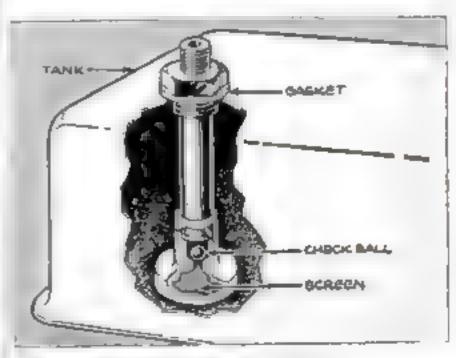
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Adding New Junction Boxes

Ir you do any house wiring, you've probably been faced with the job of breaking in on an existing Romex or other soft-sheathed line to tap off a new branch. If the original line is tightly strung, cutting it for the new junction box shortens it so that it is impossible to space without adding more wire.

One way to lick this problem is by adding the box without cutting the cable at all. Hacksaw slots from the outside edges of the box to the two side ports. Bend the slots open, and slip the box over the cable. Make the cable fast at each point of entry with a cable clamp of the side-opening type (such clamps are available for use with Romex cable). After the box and clamps are in place, you can strip the wire and add the new connections.—Kenneth H. Cassens, Rockland, Maine.



Plugged Screen Stops Engine

IF A small air-cooled gas engine fails to run because it isn't getting gas, a plugged screen in the feed pipe assembly is a likely cause. Remove the assembly from the tank by unscrewing. Then soak it in alcohol. This removes gum, restores check-ball action.—Marton L. Rhodes, Knightstown, Ind. FOR PLEASURE AND PROFIT IN SHOP AND HOME



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- ute asser as re sanding-but the dyler herder permits thank
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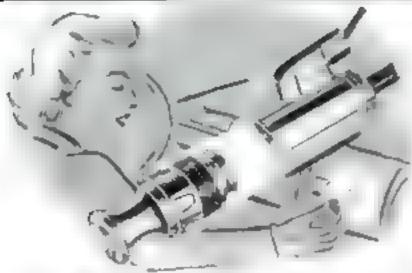
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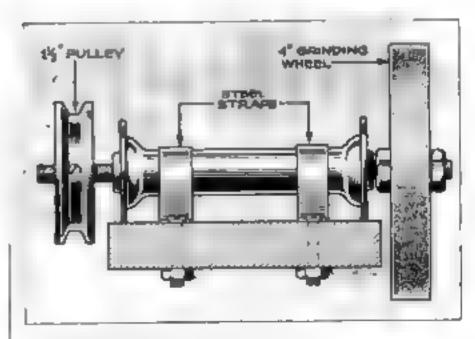
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IF YOU'RE in a hurry, you can see all 20 of the slides held by this new Multipix viewer in 20 seconds. And by sliding a button, you can go through them all again in their proper sequence. The device handles 2 by 2 transparencies in their original cardboard mounts. and an adjustable-focus lens magnifies five times. Paralex Instrument Co., of N. Y., sells it for \$14.95.



Bike Hub Serves as Arbor

You can save yourself several dollars—as I did-by making an arbor for light grinding from the hub of a bicycle's front wheel. I secured the hub to a base with two steel straps, as shown in the sketch. On one end of the axle I mounted a 11" pulley and on the other end I secured a 4" grinding wheel with two nuts.-Joseph T. Bonner, Philadelphia.



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Check Company Purchase Order for \$14.75 for Armature Tool (For vacuum cleaner, fan, sewing machine and other small motors order Small Collet and Bushing ADAPTER SET \$10.50 extra) Add local sales tax.

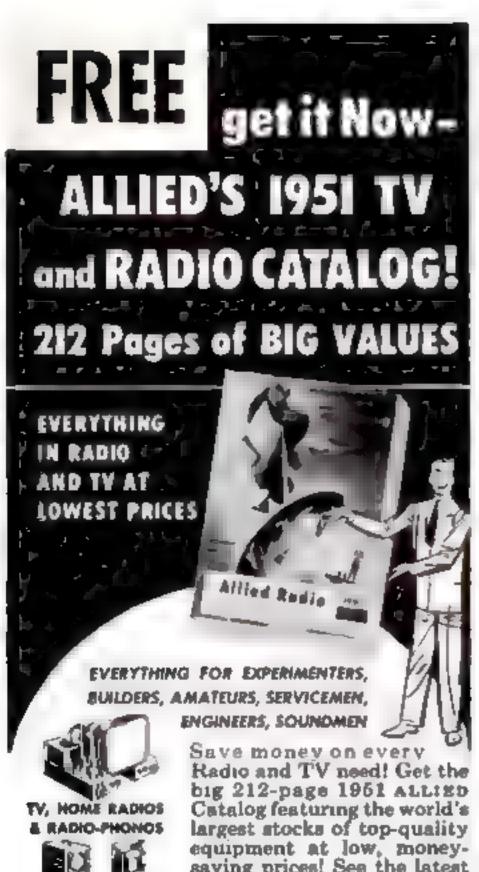
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An unusual 77-page directory telling where to get materials of such purity was recently published by the Atomic Energy Commission. It is entitled, "AECU-222, Availability and Sources of the Ninety-Six Elements in High Purity Forms," and may be obtained for 30 cents from the U S Atomic Energy Commission, Document Sales Agency, P. O. Box 62, Oak Ridge, Tenn.

Its compiler, Elwin H. Covey of the University of Cahfornia Radiation Laboratory, enlivens the directory with notes on his own efforts to get rare elements.

Hardest-to-find of any that he's sought to locate, he says, is thulium. In 1947 he placed an order with a leading dealer in rare chemicals. At last reports it was still "in preparation," which suggests the difficulty of isolating this rare-earth element.

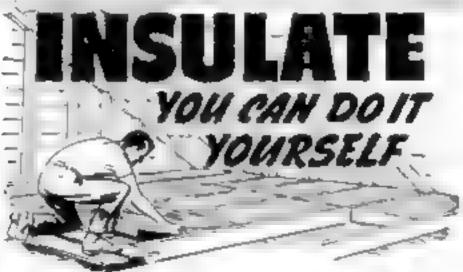
Some scientists collect rare elements, he reveals. The collections of four men in this country and of three abroad—in England, Germany, and Italy—are the likeliest sources of such prized rarities as pure dysprosium, erbium, and europium.

For completeness the directory lists all 96 elements known at the time of compilation, in 1949, although some were completely unavailable. Others, like hafnium, were marketed only as compounds. However, a New

[Continued on Page 246]







T'S a cinch to insulate your home with L Gold Bond Rock Wool Batts or Blankets. You'll save a lot of money in fuel bills and keep your house warmer in winter. cooler in summer. Light, easy-to-handle batts slide between rafters or attic floor joists. You get extra fire protection too. Gold Bond Rock Wool Batts and Blankets can't barn. Batts are 2 and 4 ft. long, Blankets 8 ft. long. Both come in standard widths to exactly fill the space between framing members. Be sure they're "fullthick" and bear the Gold Bond name for maximum insulation and fire protections For a free booklet giving details, write Division Y, Department PS-12.

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AIRBORNE SALES CO., INC. PLEYS COTY. CALM



Want the Pure Stuff?

(Continued from Page 244)

York rare-minerals dealer plans to try to prepare pure hafnium metal.

Certain AEC subcontractors, the directory notes, are the only ones in the country able to roll thin foils of pure beryllium metal.

What the compiler would like to know, himself, is where his laboratory got two tiny cubes of solid osmium. Heaviest of metals. it's usually available only in sponge form. Since he can find no record of the cubes' purchase, he thinks perhaps a graduate student made them. At any rate, he'd like to get some more. END



Spray Sampler Tests Jet Efficiency

To HELP improve the jet engines that power our latest fighting planes, engineers at the Beacon, N.Y., laboratories of the Texas Co. devised this jet-spray tester. A fan of metal tubes is placed across the diameter of the fuel spray issuing from nozzle at the top. The amount of fuel hitting each tube end is collected and measured in graduated vials at the bottom. Fuel-spray characteristics also affect the efficiency of Diesel engines and oil furnaces.

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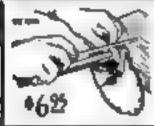
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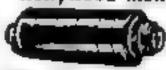
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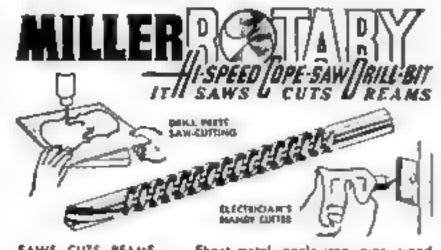
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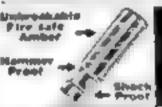
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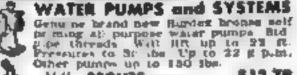
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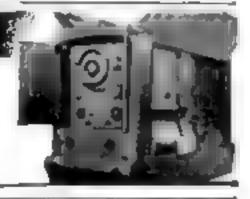
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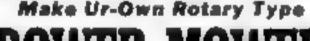
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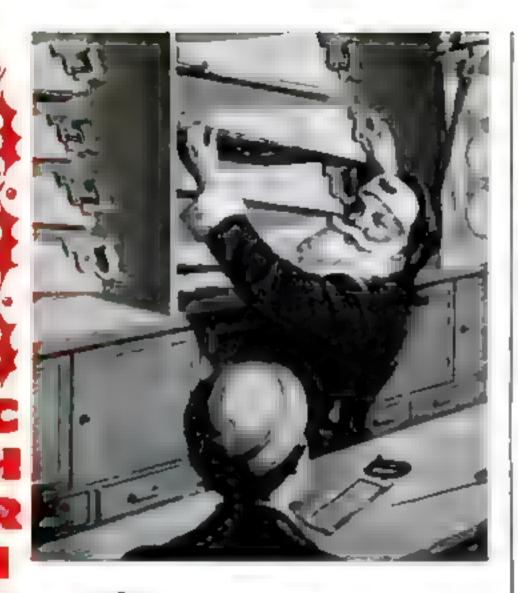


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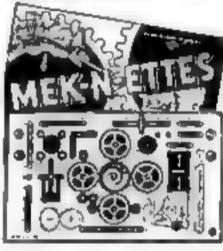


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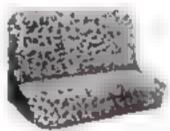
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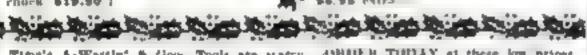
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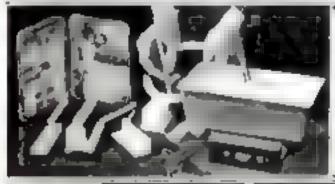
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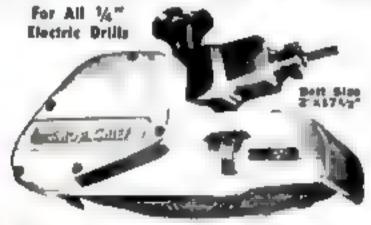
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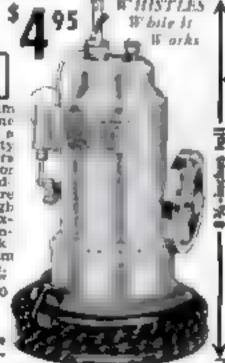
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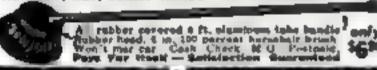
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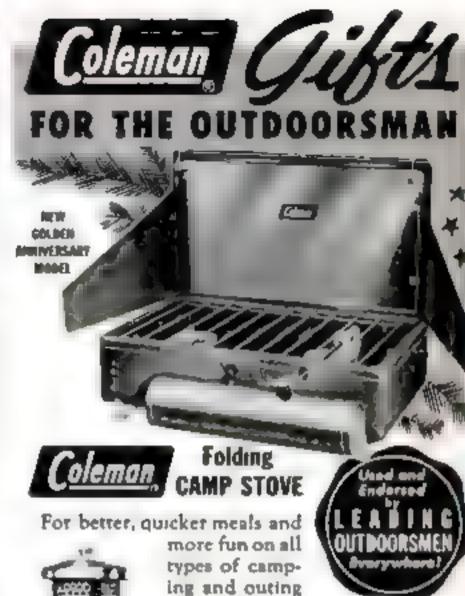
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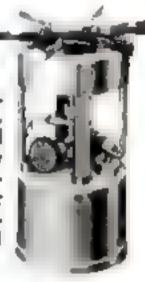
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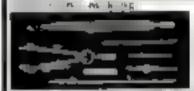
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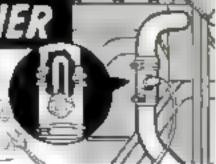
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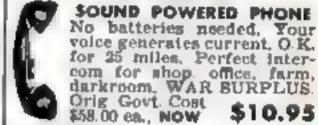
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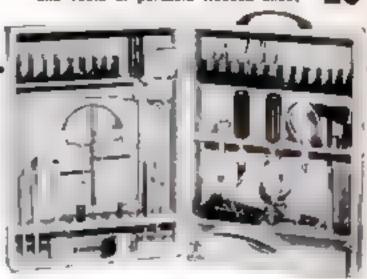
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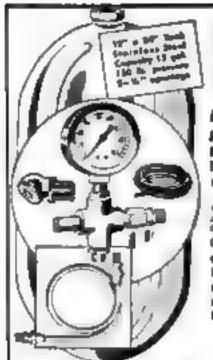
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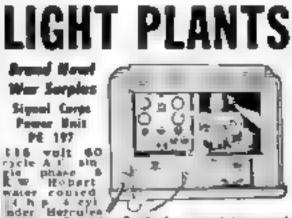
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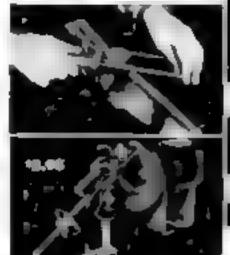
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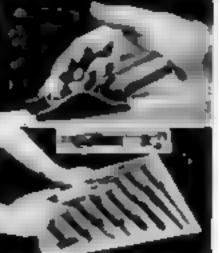
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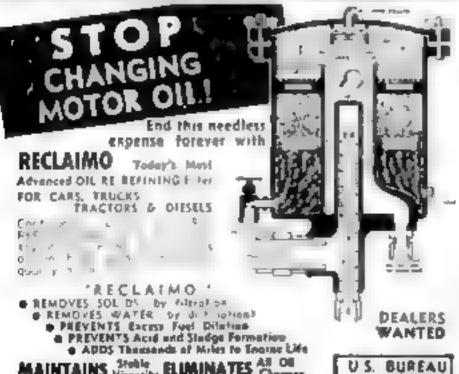
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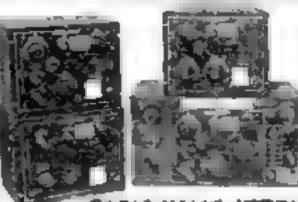
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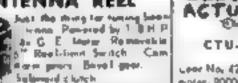
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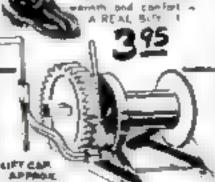
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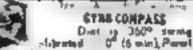
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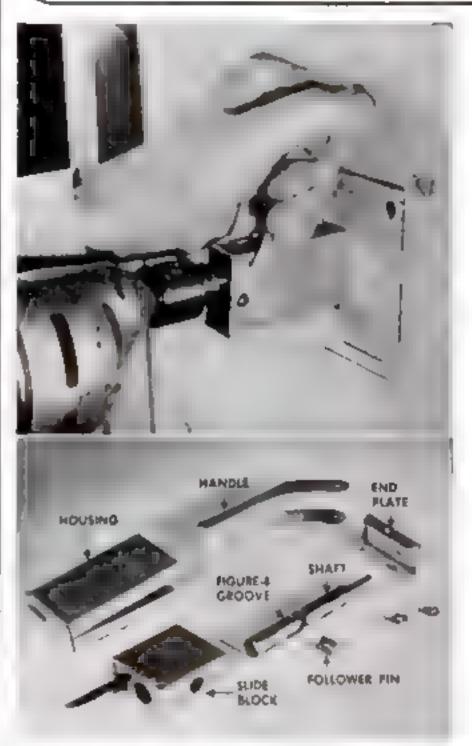
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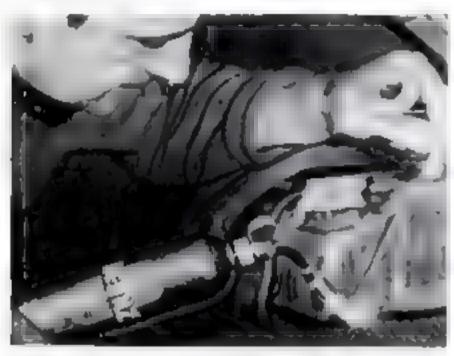


Hacksaw Unit Fits Hand Driff. A light, compact, low-cost hacksaw attachment that fits any K" electric drill or drill press now is being offered by the Bertram Engineering & Supply Co., of Kansas City, Mo. It weighs 11 oz. and costs about \$5. With the handle folded to guard the blade, it measures 1" by 1%" by 4".

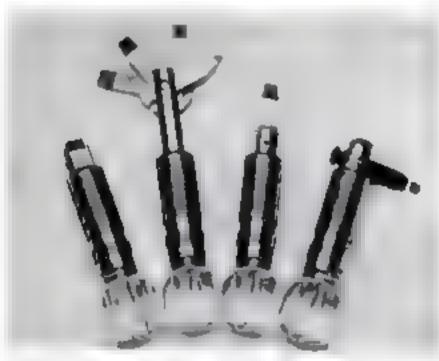
The 2-to-1 ratio of drill revolutions to saw strokes increases force at the saw teeth and prevents them from burning when used on metal. Wood, plastic, or metal up to X" thick may be cut with full chip clearance.

Here's how it works: The follower pin, set in the slide block, rides in the figure-8 groove in the shaft, moving the block back and forth as the shaft turns. There are no gears or bearings in the attachment. All moving parts are made of hardened, heat-treated steel.

Tools



Gas Torch is Refillable. This propane-burning torch is said to reach a temperature of 3,860° F. One valve turns the torch on and off and also adjusts the flame. The burner can be quickly removed to attach to a refill cartridge. Otto Bernz Co., Inc., of Rochester, N. Y., prices the torch at about \$20 with two burner tips; refill cartridges cost about \$9.50 each. Compact, the cylinder is 2%" in diameter and 11%" long.



Screwdriver Has Four Blades. When folded up, this compact tool is only 4" overall and has no blades projecting to poke holes in your pocket. The four tool-steel blades handle screws from No. I to No. 14. For extra leverage, the blades can be set at 90° to the handle. The blades pivot on a solid rivet between the side frames. Shelton Plane & Tool Mfg. Co., Shelton, Conn., prices the tool at \$1.50.



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bearing arbor miver gauge and bar r p fence guide dato meers set knobs packacrew mechanism and handwheel and all other recai parts from blade) 530 95 Same Mit with 1st Combination Stade \$24 90 Same Kit with 5 Combination Stade \$23.50

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Lower when and drive pulley runs on cested New
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(Leturn Rive in 10 days for redund if not estimated oppings include postage within 600 miles. Over 500 and 1465 Also avai(shis ... Plane and Parts Hit for 8" Tift: Table war Green Plane at \$1.00 each: sent porthers arrantees in the world or write for FREE descriptive catalog.

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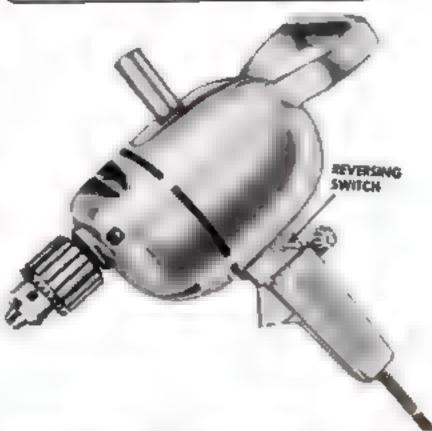
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No. 200 % "capacity Fast-drilling with add-\$16.50 ed power. With Jacobs Geared \$19.50 Chuck.

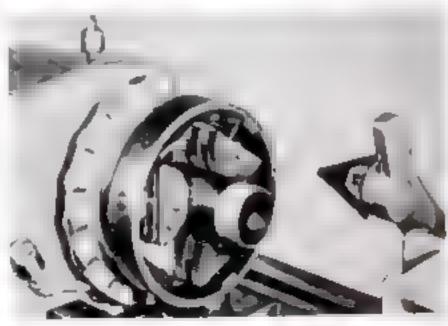
Write for Circular on driffs, grindels and sender



X New Tools



Electric Drill is Reversible. Designed for deep boring in heavy timbers, creosote planking, and sappy or wet lumber, this %" drill has a built-in reversing switch. According to Cummins Portable Tools, a division of Cummins Business Machines Corp., Chicago, this feature eliminates hand turning and difficulty in removing the bit from wood. Its capacity is K" in metal and 1" in wood. The universal motor develops 550 r.p.m. without load. Price is about \$48.



Chuck is Self-Locking. With this wrenchless chuck-developed by the Peerless Machine Co., Racine, Wis.-you can rapidly chuck, release, or re-position round work from %" to 2%" o.d. Work as short as 2%" can be gripped for threading at one end. No adjustment of the jaws is needed for gripping stock of different diameters. When the handwheel behind the chuck is turned, the three pivoted, toothed jaws grip and automatically center the work.



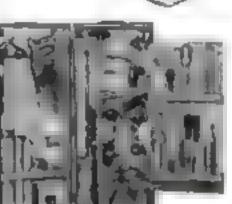
Impact Tool Turns Bolts and Screws. Twist this tool in the desired direction, rap it a few times with a hammer, and nuts. screws, or bolts can be quickly tightened or loosened. A cam principle turns the hammer impact into torque. H. K. Porter, Inc., of Somerville, Mass., sells the Impakdriver by itself or in sets with combinations of bits and sockets to fit various sizes and types of screws, nuts, and bolts.

Bolts Hammered Through Wood. It isn't necessary to drill a bolt hole, it is said, when



you use one of these pointed bolt adapters. You screw the adapter to the end of the bolt and hammer the bolt through the wood as though it were a nail. Then you unscrew the adapter for use with other bolts of the same size. The Model Patent Mfg. Co., Denver, Colo., sells them for \$3.75 in sets, each containing four adapters of the following sizes. \$16", 4", "16", and 3".

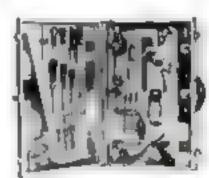




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|-------------------------------------|---|
| Hamp | |
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PS Last minute news & notes...

ATOMIC ENGINE now being designed for the Navy is called "SIR" because it will be a "ship intermediate reactor." Atoms of its fuel will be split by neutrons. These will go faster than those used to maintain a chain reaction in most piles, but slower than the neutrons used in a bomb. Hence, their energies will be intermediate. General Electric has had a small "preliminary pile assembly" of this type running for 25 years. A new method of controlling a nuclear reaction has been tried on this experimental pile and found to work "very well."

LUBRICATING OIL now can be fed to the bearings of industrial machines as steadily, automatically, and efficiently as electricity. Microscopic bits of oil are suspended in a stream of air. Like an electric motor that draws only as much energy from a power line as it needs to do its work, a bearing ciled with this mist picks up as much oil as it needs but no more. The Alemite Division of the Stewart-Warner Corp. has introduced this new system. reports that one machine which formerly consumed from 12 to 15 cunces of oil a day has used only 1.5 ounces per day since it was put on an "oil mist" diet.

SPEEDOMETERS in many new cars have purposely been set to exaggerate a little bit more than those in pre-war cars. When you go 29 m.p h., your speedometer now may read 30, and when you go 90 it may show 100. Auto makers hope that the rising margin of error will result in less dangerous speeding on crowded roads.

TELEVISION SETS came off assembly lines almost as fast as cars this year. In the first eight months, U.S. produced 4,310,462 TV sets and 4,417,147 automobiles.

FASCINATED by the idea of establishing a permanent, self-supporting colony on the Antarctic continent, a

number of young engineers and scientists have organized a nonprofit corporation to investigate the possibilities. Uranium and other resources might be found there and claimed for the U.S. in this way. So they wonder whether atomic, solar, or wind machines might not be developed to provide the pioneers with an abundance of cheap power. This, some of them say, might make feasible farming in underground caves, using fluorescent light.

RADIATION DETECTORS were being manufactured by only nine American firms in 1947, and they were turning out only 19 types. Now 84 companies are producing 180 different types. One new instrument is an electronic water monitor. It charts the radioactivity of water passing through it, and its makers urge that it be put in city pumping stations so that the survivors of an atomic bombing could be warned if water was contaminated.

THE WEST now appears to have been inhabited twice as long as eastern parts of North America. University of Chicago scientists have been checking the age of various bits of evidence--such as sandals found in caves--by determining how much radioactive carbon they contain. Their analysis of these clues indicates that human beings dwelt in Oregon and Nevada about 10,000 years ago but did not migrate to the Atlantic Coast until about 5,000 years ago.

DOCTORS are enthusiastic about a new drug called Asterol that helps cure athlete's foot. It'll be on the market this spring . . . MATCH BOOKS will soon have a new kind of striking surface that moisture will not damage . . . UPHOLSTERY in some '51 cars will be a new type of vinyl plastic that stretches in every direction and stays soft and pliable.

The Editors





New RCA Theatre Television System projects 15 x 20 foot pictures of television programs.

Giant size Television_"shot from a Barrel!"

You've seen television. Now you'll see it in its finest form—giant projections of special events transmitted only to theatres on private wires or radio beams to make moviegoing better than ever!

Success of the system comes from a remarkable RCA kine-scope, and something new in projection lenses. The kinescope, developed at RCA Laboratories, is in principle the same as the one on which you see regular telecasts. But it is small—only a few

inches in diameter—and produces images of high brilliance. These are magnified to 15 x 20 feet by a "Schmidt-type" lens system like those used in the finest astronomical telescopes.

Because of its rise and shaps, the new projector is referred to by engineers as the "barrel." It's already going into theatres, where you'll be seeing giant television—shot from a barrel.

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N Y. Admission is free Radio Corporation of America, Radio City, New York.



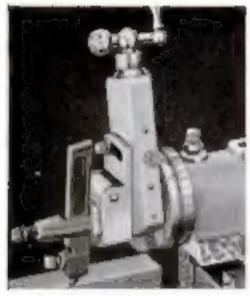
The same research which developed RCA's new theatre television system also gives you big, brilliant pictures on 1951 RCA Victor home receivers.



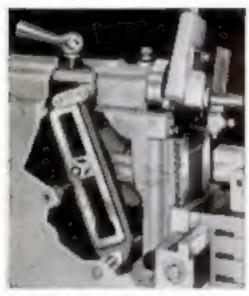
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SPECIFICATIONS

RAM-Stroke length-0 to 7". Strokes per minute (4) -42 to 195. Cutting speeds-3 to 114 feet per minute.

TOOL HEAD-Vertical feed -- 3". Swivels -- 360°. Tool Post opening -- 13/32" x 7/8".

TABLE—Horizontal travel—9-1/2". Vertical travel—5". Power cross-feeds (6)—.002" to .012". Ram clearance—1/2" to 5-1/2". Table size—5-3/8" x 5" x 6-5/16".

VISE-Jaw width-4". Jaw depth-1". Maximum opening-4". Swivel base.





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